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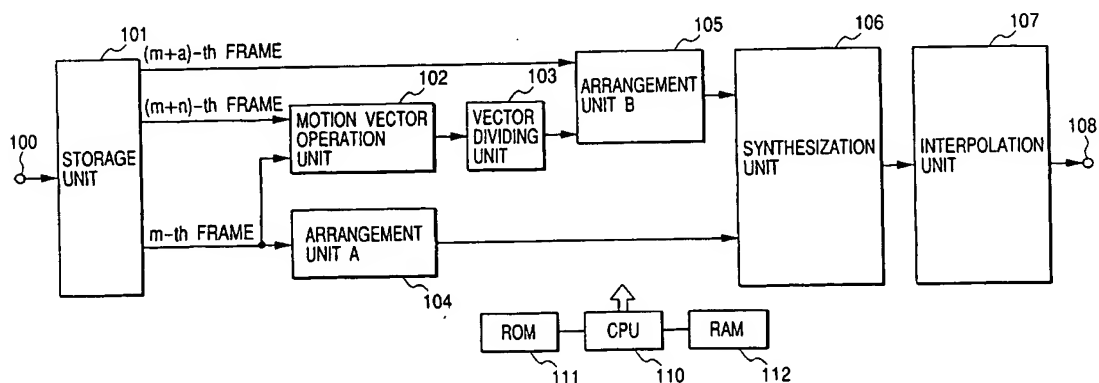
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(54) Image processing method and apparatus

(57) There is disclosed a method for obtaining one high-resolution image from a plurality of low-resolution images having predetermined resolutions, comprising steps of detecting relative positions among the plurality of low-resolution images with a resolution less than a pixel pitch in the predetermined resolutions, and forming a new image having a high resolution as compared with the predetermined resolutions using the plurality of images in accordance with information indicating the rela-

tive positions, so that the high-resolution image is obtained without any disorder. Moreover, there is disclosed a method for detecting motion vectors among a plurality of frames with a higher resolution, comprising steps of using orthogonal transform coefficients of images in the plurality of frames in motion images to detect the motion vectors among the plurality of frames with the resolution less than the pixel pitch in the predetermined resolutions.

FIG. 4**EP 1 001 374 A2**

Description

BACKGROUND OF THE INVENTION

5 Field of the Invention

[0001] The present invention relates to image processing method and apparatus, particularly to method and apparatus for forming a high-resolution image from a low-resolution image, motion vector detecting method and apparatus for use together with the image processing apparatus, method and apparatus for synthesizing a plurality of images, further to a recording medium readable by a computer which is used in these methods and apparatuses, and the like.

Related Background Art

[0002] Various methods have been heretofore proposed as methods for converting the resolution from inputted low-resolution information to high-resolution information.

[0003] In the conventional proposed resolution converting methods, a high resolution is realized by interpolating pixels to the low-resolution information, and the conversion processing method differs with the type of the object image (e.g., a multivalued image in which each pixel has gradation information, a binary image binarized by a pseudo intermediate gradation, a binary image binarized by a fixed threshold value, a character image, and the like).

[0004] As the pixel interpolating method in the conventional resolution converting method, a closest interpolating method of arranging the same pixel value closest to an interpolation point as shown in Fig. 1, a common primary interpolating method of determining the pixel value of an interpolation point E by the following operation in accordance with the distances of four points (four point pixel values are set to A, B, C, D) surrounding the interpolation point as shown in Fig. 2, and the like are generally used.

$$E = (1-i)(1-j)A + i(1-j)B + j(1-i)C + ijD \quad (1)$$

(when the distance between pixels is set to 1, the interpolation point E has a distance i in a transverse direction and a distance j in a vertical direction from A ($i \leq 1, j \leq 1$)).

[0005] Moreover, as heretofore represented by a sampling theorem, means for converting a sampled discrete signal to a continuous signal comprises passing the signal through an ideal low pass filter which can be represented by SINC function, so that the continuous signal can be reproduced. Moreover, since the operation of SINC function requires much processing time, there is proposed another method which comprises approximating the interpolation function represented by the SINC function, and calculating an interpolated value only by a simple operation of sum of products.

[0006] For example, in a known cubic convolution interpolating method, the approximating of the interpolation function can be realized. A method of calculating the interpolated value by the interpolating method will be described with reference to Fig. 3. In the pixel arrangement shown in Fig. 3, P denotes an interpolated point (interpolation point), and P11 to P44 denote pixel values of 16 pixels surrounding the point. Then, the interpolation point is interpolated using a cubic convolution function shown in the following equation. Additionally, in the following equation, x^y represents y power of x.

$$P = [f(y1)f(y2)f(y3)f(y4)] \begin{bmatrix} P11 & P12 & P13 & P14 \\ P21 & P22 & P23 & P24 \\ P31 & P32 & P33 & P34 \\ P41 & P42 & P43 & P44 \end{bmatrix} \begin{bmatrix} f(x1) \\ f(x2) \\ f(x3) \\ f(x4) \end{bmatrix} \quad \dots (2)$$

$$f(t) = \sin(\pi t) / (\pi t)$$

$$R \begin{cases} 1-2|t|^{-2}+|t|^{-3} & (0 \leq |t| < 1) \\ 4-8|t|+5|t|^{-2}-|t|^{-3} & (1 \leq |t| < 2) \\ 0 & (2 \leq |t|) \end{cases} \dots (3)$$

$$\begin{aligned} x1 &= 1+(u-[u]) & y1 &= 1+(v-[v]) \\ x2 &= (u-[u]) & y2 &= (v-[v]) \\ x3 &= 1-(u-[u]) & y3 &= 1-(v-[v]) \\ x4 &= 2-(u-[u]) & y4 &= 2-(v-[v]) \end{aligned} \dots (4)$$

[0007] (In the equation, $[]$ denotes Gauss' notation, and takes an integer portion.)

[0008] However, as a result of resolution conversion by the above-described three types of interpolating methods, a blur by interpolation, and a block-shaped jaggy dependent on input low-resolution image occur, and high quality and resolution information cannot be prepared.

[0009] To prepare the high-resolution information from the low-resolution information in such background, there is also proposed an interpolating method including a technique of realizing the resolution conversion without generating the interpolation blur attributed to the interpolating processing or the jaggy, a technique of preparing an excellent edge while maintaining the continuity of pixel values, and the like.

[0010] However, the resolution conversion by the above-described conventional interpolating method has the following defect. Specifically, even if the high-resolution information is prepared, the enhancement of image quality is limited.

[0011] As apparent from the sampling theorem, since the information with the input resolution equaling or exceeding Nyquist limit does not exist in the input image, the preparation of information with Nyquist frequency or more frequency is all based on presumption. Therefore, it is easy to convert flat artificial images such as not-complicated CG image, illustration image, and animation image to jaggy-less images, but it is difficult to enhance the image quality of a natural image by presuming the information equaling or exceeding the Nyquist limit. Specifically, even if any method is used, the image quality of the image obtained by inputting low-resolution information and converting the resolution to a high resolution is evidently deteriorated as compared with the image inputted originally as the high-resolution information.

[0012] On the other hand, with the spread of digital video cameras in recent years, it becomes easy to input the picked-up motion image into a computer in the unit of continuous one frame. Therefore, one frame of motion image can also be outputted via a printer. However, as compared with the yearly increasing output resolution of the printer, the input resolution of a picking up system tends to increase, but it is still low in the present situation.

[0013] Therefore, as described above in the conventional example, instead of preparing one frame of high-resolution still image from one frame of low-resolution still image, it is considered that one frame of high-resolution still image is prepared from a plurality of continuous low-resolution still images taken from the motion image.

[0014] The technique of preparing the high-resolution still image from the low-resolution motion image is proposed in Japanese Patent Application Laid-Open No. 05-260264. The proposed method comprises comparing images continuous in point of time, detecting parameters of affine transformation and parallel movement based on the difference of the images, and synthesizing these images. Additionally, an example in which the synthesizing method is utilized for interpolation is also mentioned.

[0015] However, this proposal has the following problem:

[0016] Specifically, in the method of utilizing the synthesizing method for the interpolation, by comparing the continuous images enlarged by the interpolating method shown in Figs. 1 to 3, the parameters are calculated to determine an interpolation position, before performing the synthesis. However, for the enlarged image obtained by the interpolation in this manner, new high-resolution information is not prepared by the interpolating operation itself. Therefore, even when the synthesis processing is performed using the enlarged image in this manner, a really high-resolution image is not necessarily obtained.

[0017] Here, the interpolation indicates the interpolation between the pixels. In the interpolation by the synthesizing method, however, when the continuous images are compared, there is not information between the pixels for creating

u f !sf t pmjupoli jhi f slü bolü f !sf t pmjupolpgü f !joqvduqjyf rü!b!pü f !sx pset -!bt t vn joh!ü bulx pluzqf t !pgjn bhf t !B!boe!C
bsf !t zou f t j!f e-ljüjt lejgüvndup!ef u f sn jof !ü f !qpt jüpolcf u f f olü f !qjyf rü!pgü f !jn bhf !B!jox i jdi !ü f !qjyf rü!pgü f !jn bhf
Cljt !up!cf !jouf sqprüf e-lpömlcz!dpn qbsjoh!ü f !f oräshf eljn bhf t /

6 \1129^ U i j t l j t l c f d b v t f !ü f !n j o i n v n l v o j u p g ü f !n p j p o l w f d u p s b n p v o u d p s s f t q p o e t !u p !b !q j y f r h o j u !b o e l u f s f !j t !o p
s f t p m j u p o l !ö f s l u b o l b l e j t u o d f l c f u f f o l a j y f r h / T q f d j o b n e l j g ü f !w d u p s s f t p m j u p o l e p f t !o p d i b w f !b !q s f d j t j p o f f r v b r t p
p s r f n t t !ü b o l u f !e j t u o d f l c f u f f o l u f !q j y f r h !ü f !f g d u s f t v r j o h !g p n !ü f !j o u f s q p r u j p o l v t j o h !b !q m s b r j e !p g t ü m j n b h f t
j t l e j n j o i t i f e !-b o e l u f !j n b h f !r v b r j e !j t !t v c t u o j b r e !v o d i b o h f e l b t !d p n q b s e !x j u !x i f o l p o f !g b n f !p g i j h i . s f t p m j u p o
t ü m j n b h f !j t !q s f q b s e !g p n !p o f !g b n f !p g r p x . s f t p m j u p o l t ü m j n b h f !b t !e f t d s c f e !b c p w f !j o !ü f !l d p o w f o j p o b r f i y b n q r f v

21 TVNNBSZIPGUI F!JWFOWUPO

\112: ^ B!dpodf solpgü f !qsf t f oljowf oüpoljt !up!t p w f !ü f !bcpw f . e f t d s c f e !q s p c r f n t /

\1131^ Bopü f !sdpodf solpgü f !qsf t f oljowf oüpoljt !up!t q s p w j e f !b o l j n b h f !q s p d f t t j o h !n f ü p e l j o !x i j d i !p o f !i j h i . s f t p .
m j u p o l j n b h f !d b o l c f !p c u j o f e !g p n !b !q m s b r j e !p g r p x . s f t p m j u p o l j n b h f t /

26 \1132^ Bddpsejoh!up!pof !bt qf düpgü f !qsf t f oljowf oüpo-lü f !s f !j t !q s p w j e f e !b o l j n b h f !q s p d f t t j o h !n f ü p e l d p n q s t j o h
t u f q t !p g j o q v u j o h !b !q m s b r j e !p g n v u w b r e !e j g f s f o l j n b h f t !i b w j o h !q s f e f u f s n j o f e !s f t p m j u p o t -l e f u d j o h !s f r u j w f !q p t j ü p o t
b n p o h !ü f !q m s b r j e !p g j n b h f t !x j u !b !s f t p m j u p o l r f n t !ü b o l !q j y f r h j u d i !j o !ü f !q s f e f u f s n j o f e !s f t p m j u p o t -l b o e !g s n j o h !b
o f x !j n b h f !i b w j o h !b !i j h i !s f t p m j u p o l b t !d p n q b s e !x j u !ü f !q s f e f u f s n j o f e !s f t p m j u p o t !v t j o h !ü f !q m s b r j e !p g j n b h f t !j o
b d d p s e b o d f !x j u !j o g s n b j p o l j o e j d b j o h !ü f !s f r u j w f !q p t j ü p o t !p c u j o f e !j o !ü f !e f u d j o h !t u f q /

31 \1133^ Bopü f !sdpodf so-lpgü f !qsf t f oljowf oüpoljt !up!t q s p w j e f !b l n f ü p e l j o !x i j d i !b l n p j p o l w f d u p s b n p o h !b !q m s b r j e
p g g b n f t !d b o l c f !e f u d f e !x j u !b !i j h i f !s f t p m j u p o l /

\1134^ Bddpsejoh!up!bopü f !sbt qf düpgü f !qsf t f oljowf oüpo-lü f !s f !j t !q s p w j e f e !b o l j n b h f !q s p d f t t j o h !n f ü p e l d p n .
q s t j o h !t u f q t !p g f y u b d j o h !b !q m s b r j e !p g g b n f t !g p n !n p j p o l j n b h f t !i b w j o h !q s f e f u f s n j o f e !s f t p m j u p o t -l d b r d v r u j o h !p s i
ü p h p o b r h s b o t g s n !d p f g ü j f o u t !p g f b d i !p g j n b h f t !j o !ü f !q m s b r j e !p g g b n f t !-l b o e !e f u d j o h !n p j p o l w f d u p s !b n p o h !ü f
q m s b r j e !p g g b n f t !x j u !b !s f t p m j u p o l r f n t !ü b o l !q j y f r h j u d i !j o !ü f !q s f e f u f s n j o f e !s f t p m j u p o t !c z l v t j o h !ü f !p s i p h p o b m
u s o t g s n !d p f g ü j f o u t /

\1135^ Zf !bopü f !sdpodf solpgü f !qsf t f oljowf oüpoljt !up!t q s p w j e f !b o l j n b h f !q s p d f t t j o h !n f ü p e l j o !x i j d i !c z l t z o u f .
t j !f j o h !b !q m s b r j e !p g j n b h f t !-l b o l j n b h f !i b w j o h !b !i j h i !s f t p m j u p o l b o e l i b w j o h !o p !e j t p s e f s d b o l c f !g s n f e /

41 \1136^ Bddpsejoh!up!b!ü jse!bt qf düpgü f !qsf t f oljowf oüpo-lü f !s f !j t !q s p w j e f e !b o l j n b h f !q s p d f t t j o h !n f ü p e l d p n q s t j o h
t u f q t !p g j o q v u j o h !b !q m s b r j e !p g n v u w b r e !e j g f s f o l j n b h f t !i b w j o h !q s f e f u f s n j o f e !s f t p m j u p o t -l d b r d v r u j o h !p s i p h p o b m
u s o t g s n !d p f g ü j f o u t !p g f b d i !p g ü f !q m s b r j e !p g j n b h f t !-l b o e !t i j g j o h !b o e !t z o u f t j !f j o h !ü f !q m s b r j e !p g j n b h f t !x j u !b
s f t p m j u p o l r f n t !ü b o l !q j y f r h j u d i !j o !ü f !q s f e f u f s n j o f e !s f t p m j u p o t !c z l v t j o h !ü f !p s i p h p o b r h s b o t g s n !d p f g ü j f o u t /

\1137^ Npsf p w f s !b d d p s e j o h !u p !b o p ü f !s d i b s b d f s t j d !p g ü f !q s f t f o l j o w f o ü p o -l ü f !s f !j t !q s p w j e f e !b o l b q q b s w t !p s !b
e f w d f !x i j d i !v t f t !ü f !b c p w f . e f t d s c f e l j n b h f !q s p d f t t j o h !n f ü p e /

46 \1138^ Gvsi f !s n p s f -!b d d p s e j o h !u p !b o p ü f !s d i b s b d f s t j d !p g ü f !q s f t f o l j o w f o ü p o -l ü f !s f !b s f !q s p w j e f e !b !q s p h s n !g s
s f b r j j o h !ü f !b c p w f . e f t d s c f e l j n b h f !q s p d f t t j o h !n f ü p e l b o e !b s f d p s e j o h !n f e j v n !s f b e b c r f l c z !b d p n q v u f s x i j d i !t p s f t
ü f !q s p h s n /

\1139^ Bewboubhf t !boe!di bsbdf s t j d t !p g ü f !qsf t f oljowf oüpolpü f !slü bolü f !bcpw f . e f t d s c f e !x j m e f !b q q b s f o u g s n
ü f !g n p x j o h !e f u j r f e !e f t d s q ü p o !p g ü f !n p e f !p g ü f !qsf t f oljowf oüpo /

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\113: ^ G h / !2 !j t !b !t d i f n b j d !w j f x !t i p x j o h !b !d r p t f t u j o u f s q p r u j o h !n f ü p e /

\1141^ G h / !3 !j t !b !t d i f n b j d !w j f x !t i p x j o h !b !d p n n p o l q s n b s z !j o u f s q p r u j o h !n f ü p e /

56 \1142^ G h / !4 !j t !b !t d i f n b j d !w j f x !t i p x j o h !b !d v c j d !d p o w p m j u p o l j o u f s q p r u j o h !n f ü p e /

\1143^ G h / !5 !j t !b !c r p d l !e j b h s b n !t i p x j o h !b o l j n b h f !q s p d f t t j o h !b q q b s w t !b d d p s e j o h !u p !b !ö t u f n c p e j n f o u p g ü f
q s f t f o l j o w f o ü p o /

\1144^ G h / !6 !j t !b !t d i f n b j d !w j f x !t i p x j o h !n p j p o l w f d u p s p q f s j p o l j o !ü f !b q q b s w t !p g G h / !5 /

61 \1145^ G h t ! / !7 B - !7 C - !7 D !b o e !7 E !b s f !t d i f n b j d !w j f x t !t i p x j o h !p o f !f y b n q r n !p g b o !b d u w b r j n b h f !n p j p o !u p !c f !i b o e r f e
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\1146^ G h t ! / !8 B - !8 C !b o e !8 D !b s f !f y q r b o b u p s z !w j f x t !t i p x j o h !ü f !t u b f t !p g n p j p o l w f d u p s !f y u b d f e !g p n !ü f !j n b h f t
t i p x o l j o !G h t ! / !7 B !u p !7 E /

\1147^ G h t ! / !9 B - !9 C !b o e !9 D !b s f !e j b h s b n !t i p x j o h !ü b ü f !n p j p o l w f d u p s t i p x o l j o !G h / !8 D !j t !e j w j e f e /

66 \1148^ G h t ! / !: B - !: C - !: D !b o e !: E !b s f !e j b h s b n !t i p x j o h !ü b ü f !n p j p o l w f d u p s t !e j w j e f e !b t !t i p x o l j o !G h t ! / !9 B !u p !9 D
b s f !v t f e !u p !t i j g l j n b h f !c r p d l t /

\1149^ G h t ! / !21 B - !21 C !b o e !21 D !b s f !t d i f n b j d !w j f x t !t i p x j o h !j o l n p s f !e f u j r t i b ü f !n p j p o l w f d u p s t !t i p x o l j o !G h t ! /
9 B !u p !9 D !b s f !e j w j e f e /

\114: ^ G h / !22 !j t !b !t d i f n b j d !w j f x !t i p x j o h !ü b ü b !q m s b r j e !p g g b n f t !p g j n b h f t !b s f !t z o u f t j !f e !c b t f e !p o !e j w j e f e

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 \1166^ Gh/!48!jt !b!c!r!p!d! !ejbhsbn !t i px joh!u f !jn bhf !qspdf t t joh!bqqbsbwt !bddpsejoh!up!bo!f jhi u !f n cpejn f oupgu
 u f !qsf t f oujowf oupo/
 \1167^ Gh/!49!jt !b!c!r!p!d! !ejbhsbn !t i px joh!u f !dpods!f !dpot yw!ypo!pgb!t f r!nd!ypo!vojulo!u f !bqqbsbwt !pg!Gh/!48/
 \1168^ Gh/!4: !jt !b!ejbhsbn !t i px joh!u f !O!u s!joh!dpf g!j!f oupg!b!q!rt!dj!bo!f ehf !f yusb!ypo!O!u s!gs!vt f !jo!u f !t f r!nd!ypo
 41 voj!pg!Gh/!49/
 \1169^ Gh/!51!jt !b!c!r!p!d! !ejbhsbn !t i px joh!u f !dpods!f !dpot yw!ypo!pgu f !ebub!qspdf t t joh!vojulo!u f !bqqbsbwt !pg
 Gh/!48/
 \116: ^ Gh/!52!jt !b!t di f n bjd!ejbhsbn !t i px joh!u f !jof sqrt!ypo!q!p!joulou!u f !jo!u f !qspdf t t joh!voj!pg!Gh/!51/
 \1171^ Gh/!53!jt !b!C!x di bs!t i px joh!b!t f s!f t !pg!qspdf t t joht !qf gsn f eljo!u f !bqqbsbwt !pg!Gh/!48/
 46 \1172^ Gh/!54!jt !b!C!x di bs!t i px joh!u f !pqf sbypo!pgu f !n b!o!qbs!pgu f !jn bhf !qspdf t t joh!bqqbsbwt !bddpsejoh!up
 b!ojou !f n cpejn f oupgu f !qsf t f oujowf oupo/
 \1173^ Gh/!55!jt !bo!f yqr!bobupsz!w!f x !t i px joh!u f !ef t sn job!ypo!pgb!s!f g!s!f od! !g!bn f !bddpsejoh!up!u f !C!x di bs!pg
 Gh/!54/
 51 EFUB!ME!EFTDS!QUPO!P!GU! F!QSGFSSFE!FN!CPEJNFOUT
 \1174^ Tpn f !f n cpejn f ou!pgu f !qsf t f oujowf oupo!x jnt!f !ef t d!scf eli f s!f job!f s!x ju !s!f g!s!f od! !up!u f !es!x joht /
 \1175^ Beej!pobrt!-!ju!jt !f g!j!f ou!p!ejt qpt f !bo!jn bhf !qspdf t t joh!n f u pe!bqqbsbwt !pgu f !qsf t f oujowf oupo!n bjom
 56 jot!jef !bo!b!b!ph!ps!ejh!ubrt!w!jef p!dbn f sb!gs!q!jd! joh!v!qn pypo!jn bhf t !ps!jot!jef !jn bhf !pv!v!ub!qqbsbwt f t !t vdi !bt !b
 q!souf sb!oe!b!w!jef p!q!souf s!dpoo!f d!f ele!js! d!m!ps!w!b!b!dpn qv!f s!up!u f !w!jef p!dbn f sb!N!ps!f p!w!f s!u f !qsf t f oujowf oupo
 d!bo!cf !jod!ps!q!sb!f e!bt !bo!jn bhf !qspdf t t joh!bqqbsbwt !dpot yw!yoh!bo!jof sn f e!j!b!f !beb!q!f s!jo!u f !dpoo!f d!ypo!pgu f
 w!jef p!dbn f sb!boe!u f !q!souf s!bt !bqq!rt!b!ypo!t pgx bs!f !jo!b!i pt !dpn qv!f s!ps!b!q!souf s!es!w!f s!t pgx bs!f !gs!ubot n ju!oh
 pv!v!ut !up!u f !q!souf s!
 \1176^ Gh/!5!jt !b!c!r!p!d! !ejbhsbn !t i px joh!u f !g!ro!d!ypo!b!rt!dpot yw!ypo!pgb!dpn qv!f s!bt !bo!jn bhf !qspdf t t joh!bqqbsbwt
 61 bddpsejoh!up!b!O!u f n cpejn f oupgu f !qsf t f oujowf oupo!U!i f !pqf sbypo!qspdf evs! b!x jnt!px !cf !ef t d!scf e!x ju !s!f g!s!f od!
 up!Gh/!5!Beej!pobrt!-!jo!u f !f n cpejn f ou!bo!f ybn qrt!x jnt!f !ef t d!scf e!j!ob!x i jdi !u f !jn bhf !q!jd! f e!v!q!cz!b!ejh!ubrt!w!jef p
 dbn f sb!jt !ubot n ju!f e!up!b!dpn qv!f s!boe!ubot gsn f e!up!qsp!w!jef !b!s!f t p!m!ypo!dpss!f t qpoejoh!up!u b!up!gb!q!souf s!cz
 bqq!rt!b!ypo!t pgx bs!f !jo!u f !dpn qv!f s!
 \1177^ Gh/!5!t i pxt !b!c!r!p!d! !ejbhsbn !pgb!g!ro!d!ypo!pgb!dpn qv!f s!qsf t f ou!f e!bt !bo!jn bhf !qspdf t t joh!bqqbsbwt !pgu f
 66 O!u f n cpejn f oupgu f !qsf t f oujowf oupo!// f s!f job!f s!bo!pqf sbypo!t f r!v!f od! !pgu f !dpn qv!f s!jt !f yqr!t!jof e!l!o!s!f g!s!f od!
 up!Gh/!5!b!u!jt !f n cpejn f ou!ju!jt !f yqr!t!jof e!bt !bo!f ybn qrt!u b!bo!jn bhf !q!jd! f e!v!q!cz!b!ejh!ubrt!w!jef p!dbn f sb!jt
 ubot n ju!f e!up!u f !dpn qv!f sb!oe!u f o!dpow!s!f e!ljou!bo!jn bhf !pg!s!f t p!m!ypo!dpss!f t qpoejoh!up!u b!up!gb!q!souf s!cz!bo
 bqq!rt!b!ypo!t pgx bs!f !t up!s!f e!jo!u f !dpn qv!f s!

\1178^ Jb!Gh/!5-lovn f sbr211!ef opuf t!bo!joqvuf sn jobrvb!x i jdi lu f!n p!poljn bhf!lqdl f e.vqlczlu f!wef pldbn f sb
 jt lubot n juf eljoulu f!lqdl qvuf s!B!vt f s!s! qsevd f t lu f!n p!poljn bhf t!lqdl f e.vqlczlu f!ejhjbv!ef p!dbn f sb!gpn lb
 s!f d!sejoh!n f ejvn -!boe!t f oet!bo!jn bhf!lqdl vq!lqdn n boe!l!b!ef t!j!s!f el!t d!f of /!B!qmsbr!w!lpgdpoujovpvt lqbn f t!lpgjn bhf
 6 jogpn b!ypo!jn n f ejb!f r!bz!gf sl!u f!lqdl vq!lqdn n boe!l!t!t v!f el!b!s!t!t up!s!f el!o!b!t!t up!sb!f! voju212!l!o!u f!lqdn qvuf sl!o!t zo.
 di spo!j! b!ypo!x ju lu f!lqdl vq!lqdn n boe!l!B!n p!pol!w!f d!ps!pqf sb!ypo!voju213!l!t!n f bot!x i jdi!n f bt!vs!t!t lu f!n p!w!f n f ou
 bn pvoud!q!bs!jbr!m p!w!f n f ou!bt!b!w!f d!ps!c!b!t f el!po!u f!l!ej!g!f s!f od!f!lpg!x pl!z!q!f t!lpg!jn bhf t!l!Bee!j!ypo!b!m!lu f!n p!ypo!w!f d!ps
 pqf sb!ypo!voju213!x j!m!f!ef t!d!s!c!f el!b!f!s!j!o!ef u!b!r!Ovn f sbr214!ef opuf t!b!w!f d!ps!ej!w!ejoh!vo!l!ps!ej!w!ejoh!u f!l!d!br!v!r!u!f e
 w!f d!ps!j!o!p!b!q!msbr!w!lpg!w!f d!ps!t!-!boe!u f!ef u!b!r!u f!s!f p!g!x j!m!f!ef t!d!s!c!f el!b!f!s!
 \1179^ Ovn f sbr215!ef opuf t!b!o!l!b!ss!boh!f n f ou!vo!j!B!l!p!d!pou!p!r!u!f! l!q!y!f r!b!ss!boh!f n f ou!p!g!u f!l!q!dl f e.vqljn bhf t!l!N!p!s!f .
 21 p!w!f s!b!o!l!b!ss!boh!f n f ou!vo!j!C!216!d!pou!p!r!u!f! l!q!y!f r!b!ss!boh!f n f ou!p!l!c!f!l!j!o!f s!q!r!u!f el!p!u f!l!jn bhf!x ju lu f!l!q!y!f r!b!ss!boh!f e
 cz!u f!l!b!ss!boh!f n f ou!vo!j!B!215!j!o!b!d!p!s!e!b!o!d!f!x ju lu f!l!bn pvoud!p!g!w!f d!ps!t!l!ej!w!ef el!cz!u f!l!w!f d!ps!ej!w!ejoh!vo!j!u214!l!B
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 Bo!l!o!f s!q!r!u!f!vo!j!u218!l!d!br!v!r!u!f!t!l!vo!O!r!ne!l!j!o!gn sb!ypo!l!p!g!j!o!f s!q!r!u!f!vo!j!u218!l!c!z!u f!l!j!o!f s!q!r!u!f!p!q!f sb!ypo!x i f!o!u f
 26 j!n bhf!t!zou f!t!j!f!el!j!o!u f!t!zou f!t!j!j!o!h!vo!j!u217!l!t!l!o!p!u!O!r!ne!x ju lu f!l!j!o!gn sb!ypo!l!p!g!u f!l!j!o!f s!q!r!u!f!vo!j!u218!l!c!z!u f!l!j!o!f s!q!r!u!f!p!q!f sb!ypo!x i f!o!u f
 s!f t!p!m!j!o!p!X i f!o!u f!l!j!o!f s!q!r!u!f!vo!j!u218!l!h!f of sb!u f!t!t!v!g!d!j!f ou!q!y!f r!b!p!l!b!d!i j!f w!lu f!ef t!j!s!f el!s!t!t p!m!j!o!p!-!i j!h!i!s!f t!p!m!j!o!p!
 j!t!l!b!d!i j!f w!el!j!o!u f!l!f n c!pe!j!n f ou!Ovn f sbr219!l!ef opuf t!b!o!l!p!v!q!v!u!f sn jobrvb!x i jdi lu f!l!jn bhf!l!j!o!gn sb!ypo!x ju!l!bo
 f oi!b!o!d!f el!s!t!t p!m!j!o!p!jt!l!ubot n juf el!p!u f!l!q!s!o!f s!b!o!e!u f!l!j!h!f /
 \117: ^ Ovn f sbr221!ef opuf t!DQV!x i jdi!l!p!o!u!p!r!u!f! l!p!q!f sb!ypo!l!p!g!f b!d!i!l!p!o!t!u!v!j!p!o!e!f t!d!s!c!f el!b!c!p!w!f!l!o!b!h!f of s!b!r!j!o!h
 n boof!s!j!o!b!d!p!s!e!b!o!d!f!x ju lu f!l!p!o!u!p!r!u!f!s!h!s!bn!l!f r!e!l!j!o!SPN!222!-!boe!SBN!223!l!t!l!v!t f el!b!t!lu f!l!p!q!f sb!ypo!l!b!s!f!l!p!g!u f
 31 DQV!221/
 \1181^ B!l!q!p!d!f t!t!j!o!h!l!o!u f!l!n p!ypo!w!f d!ps!pqf sb!ypo!voju213!x j!m!f!y!l!c!f!ef t!d!s!c!f el!j!o!ef u!b!r!u
 \1182^ V!b!s!p!v!t!n f u!pet!l!p!s!d!b!r!v!r!u!j!o!h!u f!l!n p!ypo!w!f d!ps!t!b!w!f!l!c!f f o!l!q!s!q!p!t f e!l!c!v!u!b!n f u!pe!l!v!t!j!o!h!t!p!d!b!r!ne!l!u f n q!r!u!f
 n b!u!l!j!o!h!x j!m!f!ef t!d!s!c!f el!i f!s!f!j!o!b!g!f s!
 \1183^ B!t!l!t!i!p!x o!l!j!o!Gh/!6!-!b!u!f n q!r!u!f!l!p!s!b!l!c!p!d!l!l!b!w!j!o!h!O2 x!O2!l!q!y!f r!b!l!t!n p!w!f el!po!b!t!f b!s!d!i!l!s!boh!f!l!N2!l!O2!l!2*
 36 _3!j!o!b!l!r!b!s!h!f!s!j!o!q!v!u!j!n bhf!x ju!l!N2 x!N2!l!q!y!f r!b!l!b!o!e!u f!l!r!h!g!l!v!q!q!f s!q!p!t!j!ypo!l!p!g!b!u!f n q!r!u!f!l!jn bhf!l!t!l!p!c!u!b!j!o!f el!j!o!x i jdi
 u f!l!s!f t!j!ev!b!r!h!f!q!s!t!f o!u!f el!c!z!u f!l!g!m!p!x!j!o!h!l!f r!v!b!ypo!l!6*!l!t!n j!o!j!n v!n /!l!b!u!j!t!l!d!b!t f!-!n b!u!l!j!o!h!l!t!s!f!h!b!s!f el!b!t!l!b!w!j!o!h!l!c!f f o
 b!d!i j!f w!e/

S)b-c* > TT\j)b-c")n 2-o2*.U)n 2-o2*))6*

\1184^)b!u f!l!f r!v!b!ypo!-!u f!l!r!h!g!l!T!l!t!l!j!o!u f!l!s!boh!f!l!p!gn r!t!l!l!p!O2.2!-!boe!u f!l!s!h!i u!T!l!t!l!o!r!t!l!l!p!O2.2*
 \1185^ Bee!j!ypo!b!m!-!j!o!u f!l!f r!v!b!ypo!l!6*-!j!b!-!c*!j!o!e!j!d!b!u!f t!lu f!l!r!h!g!l!v!q!q!f s!q!p!t!j!ypo!l!p!g!u f!l!u f n q!r!u!f!l!jn bhf!l!j!o!u f!l!j!o!q!v!u!j!n bhf -
 J!b!-!c")n 2!-!o2*!j!o!e!j!d!b!u!f t!lu f!l!q!b!s!j!b!r!j!n bhf!l!p!g!u f!l!j!o!q!v!u!j!n bhf -!boe!U)n 2!-!o2*!l!t!lu f!l!u f n q!r!u!f!l!jn bhf /
 46 \1186^ J!b!u!j!t!l!d!b!t f!-!x i f!o!u f!l!n b!u!l!j!o!h!ef!w!b!u!f t!-!u f!l!s!f t!j!ev!b!r!h!t!l!s!b!q!e!r!z!j!o!d!s!f!b!t f!e!l!ev!j!o!h!t!f!s!b!r!h!Bee!j!ypo!l!p!g!u f!l!q!y!f r!v!
 l!p!t!p!w!f!lu f!l!q!s!p!c!r!h!n -!l!b!s!f t!j!ev!b!r!h!f r!v!f o!j!b!r!h!f t!j!o!h!n f!u!pe!l!d!p!n q!s!t!f!l!w!e!h!j!o!h!u b!u!l!f!n b!u!l!j!o!h!l!t!l!j!o!t!v!g!d!j!f ou!x i f o
 u f!l!s!f t!j!ev!b!r!h!f!y!d!f et!l!b!d!f sb!j!o!u!s!f t!i!p!r!a!w!b!m!f!l!ev!j!o!h!u f!l!Bee!j!ypo!l!t!i!p!x o!l!j!o!u f!l!f r!v!b!ypo!l!6*!l!p!t!l!p!q!u f!l!Bee!j!ypo!-!boe
 t!i!j!g!j!o!h!l!p!u f!l!o!f!y!l!p!q!f sb!ypo!l!p!g!b!-!c*!
 \1187^ T!q!f d!j!O!b!r!m!-!x i f!o!l!j!u!t!l!b!t!v!n f el!u b!u!x pl!z!q!f t!l!p!g!jn bhf t!l!b!s!f!l!p!o!j!o!v!p!v!t!l!jn bhf t!l!p!o!l!bo!jn b!ypo!-!l!c!z!l!v!t!j!o!h!u f
 51 b!c!p!w!f!ef t!d!s!c!f el!n f!u!pe!-!u f!l!h!f p!n f!u!s!d!l!ef!w!b!ypo!l!c!f!u!x f!f o!l!c!p!u!l!jn bhf t!l!d!b!o!f!b!t!j!m!l!c!f!l!r!v!b!o!j!u!b!j!w!f!r!z!e!f!u!s!n j!o!f e/
 \1188^ B!t!lu f!l!n p!ypo!w!f d!ps!pqf sb!ypo!n f!u!pe!-!l!b!i!j!h!i f!s!q!s!d!j!t!j!p!o!n f!u!pe!l!i!b!t!l!b!r!n!p!l!c!f!f!o!l!q!s!q!p!t f e!l!c!v!u!b!n!l!p!d!j!r!n!b!u!f
 u f!l!ef t!d!s!q!j!o!p!-!u f!l!b!c!p!w!f!ef t!d!s!c!f el!n f!u!pe!l!c!z!u f!l!u f n q!r!u!f!l!n b!u!l!j!o!h!l!t!l!v!t f el!j!o!u f!l!f n c!pe!j!n f ou!
 \1189^ Bee!j!ypo!b!m!-!l!g!s!u f!l!n p!ypo!w!f d!ps!c!z!u f!l!u f n q!r!u!f!l!n b!u!l!j!o!h!-!u f!l!n b!u!l!j!o!h!l!o!x i jdi!lu f!l!s!f t!j!ev!b!r!h!t!n j!o!j!n v!n
 j!t!l!ef u!d!f el!-!boe!u f!l!s!f t!p!m!j!o!p!l!p!g!u f!l!w!f d!ps!j!t!l!b!q!y!f r!v!o!j!u!b!t!l!ef t!d!s!c!f el!b!c!p!w!f!l!T!q!f d!j!O!b!r!m!-!l!o!p!l!s!f t!p!m!j!o!p!l!o!f!sl!u b!o!l!u f
 56 e!j!t!u!b!o!d!f!l!c!f u!x f!f o!l!q!y!f r!b!l!t!l!q!s!p!w!ef e!l!l!j!t!l!w!f s!z!l!f!g!f d!j!w!f!l!p!v!t f!lu f!l!u f n q!r!u!f!l!n b!u!l!j!o!h!l!t!n p!ypo!l!d!p!n q!f ot!b!ypo!l!ev!j!o!h
 d!pe!j!o!h!-!l!c!v!u!g!s!u f!l!b!q!q!r!d!b!ypo!l!p!u f!l!j!o!f s!q!r!u!f!ypo!-!u b!u!j!t!-!u f!l!j!o!f s!q!r!u!f!j!o!h!l!u!di o!j!r!v!f!l!p!g!O!r!n!h!u f!l!j!o!gn sb!ypo!l!c!f!u!x f!f o
 u f!l!q!y!f r!b!l!O!f!s!f t!p!m!j!o!p!l!t!l!o!f!d!f t!t!b!s!z!
 \118: ^ U!i f!s!f!g!s!f!-!j!o!u f!l!f n c!pe!j!n f ou!l!j!o!t!u!f!b!e!l!p!g!d!b!r!v!r!u!j!o!h!u f!l!n p!ypo!w!f d!ps!p!g!u!pl!z!q!f t!l!p!g!d!p!o!j!o!v!p!v!t!l!jn bhf t!-
 u f!l!n p!ypo!w!f d!ps!p!g!u!pl!z!q!f t!l!p!g!jn bhf t!l!b!q!b!s!u!g!p!n!l!f!b!d!i!l!p!u f!l!s!j!o!t!b!n q!r!n!h!l!jn f!l!t!l!d!b!r!v!r!u!f e/
 61 \1191^ T!q!f d!j!O!b!r!m!-!l!g!s!u!x pl!z!q!f t!l!p!g!jn bhf t!l!ubot n juf el!p!u f!l!n p!ypo!w!f d!ps!pqf sb!ypo!voju213!l!g!p!n lu f!l!t!t!up!sb!f!voju
 212!-!p!o!f!l!jn bhf!l!t!l!b!d!f sb!j!o!l!jn bhf!l!i!f!s!f!j!o!b!g!f!s!s!f!el!p!b!t!lu f!l!n .u!l!g!b!n f!l!l!n n f ej!b!f!r!bz!gf!sl!u f!l!v!t f!s!j!t!t!v!t!t!lu f
 q!d!l vq!lqdn n boe!-!boe!u f!l!p!u f!l!s!j!n bhf!l!t!l!o!u!l!g!b!n f!l!b!g!f!sl!u f!l!n .u!l!g!b!n f!l!i!f!s!f!j!o!b!g!f!s!s!f!el!p!b!t!lu f!l!n) , o*.u!l!g!b!n f!-
 o?2*!l!Bo!f!y!b!n q!r!h!p!g!o!>!4!x j!m!o!p!x!l!c!f!ef t!d!s!c!f el!l!b!u f!l!n p!ypo!w!f d!ps!pqf sb!ypo!voju213!-!u f!l!h!f of sb!ypo!l!p!g!w!f d!ps
 n p!w!f n f ou!j!t!l!ef u!d!f el!c!f!u!x f!f o!l!n .u!l!g!b!n f!l!jn bhf!l!boe!l!n , 4*.u!l!g!b!n f!l!jn bhf!l!P!g!d!p!v!s!f!-!u f!l!s!f t!p!m!j!o!p!l!p!g!u f!l!n p!ypo
 66 w!f d!ps!d!b!r!v!r!u!f el!b!u!j!t!l!l!jn f!l!l!b!q!y!f r!v!o!j!u!boe!l!t!l!f r!v!b!r!n!p!l!b!q!y!f r!v!j!u!d!i /
 \1192^ U!i f!l!q!s!p!d!f t!t!j!o!h!l!o!u f!l!w!f d!ps!ej!w!ejoh!vo!j!u214!x j!m!f!y!l!c!f!ef t!d!s!c!f el!j!o!ef u!b!r!u
 \1193^ U!i f!l!w!f d!ps!ej!w!ejoh!vo!j!u214!l!t!l!p!o!t!u!v!u!f el!p!g!b!e!w!ef!s!x i jdi!l!q!f!s!p!n t!l!ej!w!t!j!p!o!x ju!l!b!w!b!m!f!l!p!g!o!l!p!d!p!w!f!sl!u f
 w!f d!ps!bn pvoud!p!w!f el!bn p!o!h!u f!l!b!g!b!n f!t!l!p!u f!l!w!f d!ps!bn pvoud!q!f!s!g!b!n f!l!c!b!t f el!po!u f!l!n p!ypo!w!f d!ps!bn pvoud!b!r!v!r!u!f e

jolu f ln pypo!wf dups!pqf sbypo!voju213/

1194^ Bt lef t dscf elbcpwf -lprof di bsbdf stj yd!pgu f ln cpejn f ou!jt l!olu bulu f !sf t pny!po!pgu f ln pypo!wf dups!jt t f d!p!cf !Cof slu bolu f !cf ux f f o,qjyf r!ejt ubodf !)qjudi *!up!qf spsn lu f !jouf sqp!t!ypo!/.!lu f ln cpejn f ou!lj!t !bt vn f e u bulu f ln pypo!wf dups!dpn qrhuf r!ejf bsz!n pwf t !jolq!p!o!p!g!n f /X i f olu f ln pypo!wf dups!r!ejf bsz!n pwf t !jou!jt ln boof s cz!db!r!v!r!t!u!h!u f ln pypo!wf dups!bulj f !jouf sw!b!r!p!g!b!q!r!v!r!t!p!g!b!n f t !boe!dpowf sjoh!u f !wf dups!bn pvoul!u f !bn pvou qf s!g!b!n f -lu f !wf dups!Cof slu bolu f !cf ux f f o,qjyf r!ejt !dbolcf !db!r!v!r!t!u!f !bn poh!u f !dpo!jovpvt !g!b!n f t /

1195^ Beej!ypobn!t jodf !u f !f n cpejn f ou!jt !f t ub!r!n i f elcbt f elpolu f !bcpwf .ef t dscf elbt t vn q!po-lu f !g!n!p!x!h!t !r!h!i !sf t !sd!p!o!b!q!r!t!t /!T!qf d!j!C!b!r!n!x i f olu f !bn pvoul!u f ln pypo!wf dups!bn poh!u f !o!g!b!n f t !jt !f ydf t t !j!wf r!z!r!b!shf bt !dpn q!b!f e!x!ju lu f !w!b!r!f !p!go-lu f !q!sf d!t !p!o!p!gu f !wf dups!bn pvoul!u f !g!b!n f !jt !ef t !f !p!s!b!f el!jo!t !pn f !dbt f t /

1196^ X i f olu f !p!c!f !d!jn b!h!f !jt !op!b!s!q!j!r!n !p!j!o!h!j!n b!h!f !t !v!d! !bt !t !q!s!t !d!f !-!c!v!j!t !b!f !r!u!j!f !r!z!r!t !t !n !p!j!o!h!j!n b!h!f !p!g!dpn n f n !p!s!b!f !q!j!d! !j!o!h!v!q-lt !d!f !-!q!r!b!o!u!t !j!n!r!j!f -!p!s!u f !j!h!f -!u f !b!c!t !p!m!f !n !p!w!f n f !o!b!n !p!v!o!j!t !t !n !b!r!j!o!n !b!o!z!c!r!p!d! t !p!gu f !j!n b!h!f !/!U!f o-l!j!o!u f ln pypo!wf dups!ef t !d!j!o!h!n f u !p!e!c!z!u f !u f !n !q!r!u!f !n !b!u!d! !j!o!h!t !i !p!x!o!j!o!G!h!/16-lu f n pypo!bn pvoul!b!w!s!b!r!n!e!j!f!f !x!ju lu f !c!r!p!d! !v!o!j!u!U!f !s!f !g!s!f -!j!u!j!t !d!p!o!t !e!f !s!f !e!u! bulu f !c!r!p!d! !i !b!j!o!h!b!r!b!shf !s!n !p!w!f n f !o!b!n !p!v!o!u!d! !b!b!l!q!s!f !e!f !t !s!n !j!o!f !e!w!b!r!f !jt !d!p!o!t !j!u!f !e!l!o!p!d! !c!f !e!j!w!e!f !e/

Qjyf r!B!s!b!o!h!f n f ou!P!v!u!j!e!

1197^ U!f !b!s!b!o!h!f n f ou!v!o!j!u!B!215!b!s!b!o!h!f !t !n .u !g!b!n f !q!j!yf !r!n!-!boe!u f !b!s!b!o!h!f n f ou!v!o!j!u!C!216!b!s!b!o!h!f !t !j!o!u!f !s!q!p!r!u!j!o!q!j!yf !r!n!l!u!f !n .u !g!b!n f !j!n b!h!f !j!o!b!d!d!p!s!e!b!o!d!f !x!ju lu f !wf dups!ej!w!ej!o!h!bn !p!v!o!u!T!qf d!j!C!b!r!n!u!f !g!b!n f !j!o!q!v!u!f !e!l!u!p u f !b!s!b!o!h!f n f ou!v!o!j!u!C!216!j!t !n , b.u !g!b!n f !j!b!>2!l!p!o.2**!-!j!o.2**!g!b!n f !q!j!yf !r!n!b!f !t f !s!b!r!n!j!o!q!v!u!f !e!-!boe!u f !q!j!yf !r!n!b!r!f !t !p!gu f !j!o!u!f !s!q!p!r!u!j!o!q!j!yf !r!n!b!f !b!s!b!o!h!f !e!l!j!o!b!d!d!p!s!e!b!o!d!f !x!ju lu f !e!j!w!ej!o!h!bn !p!v!o!u/

1198^ !b!u!jt !dbt f -lu f !e!j!w!ej!o!h!bn !p!v!o!u!s!o!t !n !j!u!f !e!l!g!p!n !u f !wf dups!ej!w!ej!o!h!v!o!j!u!214!j!t !2!o!l!p!gu f ln pypo!wf dups!x i !j!d! !t !n !v!n!q!r!j!f !e!l!c!z!b!l!j!o!u f !b!s!b!o!h!f n f ou!v!o!j!u!C!216!/T!qf d!j!C!b!r!n!u!f !n pypo!wf dups!x!i!b!o!r!j!o!e!j!d!b!t !u f !b!s!b!o!h!f n f ou!q!p!t !j!p!o!x i f olu f !j!n , b*.u !g!b!n f !j!t !j!o!q!v!u!f !e/

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119: ^ G!ht /!7B!l!p!7E!l!b!f !e!j!b!h!s!n !t !t i !p!x!j!o!h!f !y!b!n !q!r!n!t !p!g!b!d!w!b!r!j!n b!h!f !n !p!j!o!/.!lu f !f !y!b!n !q!r!n!b!l!q!j!d! f !e!v!q!p!c!f !d!u !p!s!b!d!b!n f !s!b!h!s!e!v!b!r!n!n !p!w!f t !j!o!b!o!p!c!r!j!n !v!f !e!j!s!f !d!j!p!o!G!ht /!7B!l!p!7E!t i !p!x! !n .u !l!p!j!n , 4*.u !g!b!n f !j!n b!h!f !t -!s!f t !q!f !d!j!w!f !r!z!r!t /

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11: 2^ G!ht /!9B!l!p!9D!t i !p!x! !u f !t !u!b!t !t !p!g!e!j!w!t !p!o!p!gu f ln pypo!wf dups!t i !p!x!o!j!o!G!h!/8D!G!h!/9B!t i !p!x! t !u f !d!b!r!v!r!t!u!f !e !n pypo!wf dups!g!s!u !s!f !g!b!n f t -!G!h!/9C!t i !p!x! t !u f !e!j!w!ej!o!h!p!gu f !wf dups!p!g!G!h!/9B!l!p!2!o!l!-!boe!G!h!/9D!t i !p!x! t !u f !e!j!w!ej!o!h!p!gu f !wf dups!p!g!G!h!/9B!l!p!3!o!l!T!qf d!j!C!b!r!n!t !jodf !u f !wf dups!bn !p!v!o!u!t i !p!x!o!j!o!G!h!/9B!n !p!w!f t !g!s!u !s!f !g!b!n f t -lu f !wf dups !j!t !e!j!w!e!f !e!l!c!z!u f !lo!v!n !c!f !s!p!g!b!n f t /

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11: 4^ U!f !q!j!yf !r!b!s!b!o!h!f n f ou!j!o!u f !f !n cpejn f ou!x !j!n!c!f !ef t !d!s!c!f !e!l!f !s!f !j!o!b!g!f !s!j!o!n !p!s!f !ef !u!j!r!h

11: 5^ G!ht /21B!l!p!21D!b!f !e!j!b!h!s!n !t !t i !p!x!j!o!h!u f !t !u!b!t !t !p!g!w!f dups!ej!w!t !p!o!j!o!e!f !u!j!r!h!boe!l!j!o!u!f !s!f !d!j!p!o!q!p!j!o!u!t !p!g!w!f !s!j!d!b!n !boe!l!i !p!s!j!p!o!u!b!r!n!u!b!j!h!i !u!j!r!o!f t !j!o!e!j!d!b!u!f !q!j!yf !r!q!p!t !j!p!o!t !/B!o!l!b!s!s!p!x !d!p!o!o!f !d!j!o!h!d!j!s!d!r!h!n !b!s!t !j!o!G!h!/21B!j!o!e!j!d!b!u!f t !u f !n pypo !wf dups!d!b!r!v!r!t!u!f !e!b!n !poh!u f !j!n b!h!f !p!gu f !n .u !g!b!n f !boe!j!n , o*.u !g!b!n f !/U!f !q!s!f t !v!n f !e!l!b!t f !p!go!>4!x !j!n!c!f !ef t !d!s!c!f !e !f !s!f !j!o!b!g!f !s/

11: 6^ U!f !n pypo!wf dups!t i !p!x!o!j!o!G!h!/21B!n !p!w!f t !u!l!u f !r!f!n!g!l!c!z!u !s!f !q!j!yf !r!n!boe!l!v!q!x !b!s!e!l!c!z!u !p!q!j!yf !r!v!T!qf d!j!C!b!r!n!u f !wf dups!n !p!w!f n f ou!g!s!u !s!f !g!b!n f t !j!t !t i !p!x!o!l!c!z!u f !b!s!s!p!x!/B!o!l!b!s!s!p!x !d!p!o!o!f !d!j!o!h!d!j!s!d!r!h!boe!l!u!j!b!o!h!r!h!n !b!s!t !j!o!G!h!/21C !t i !p!x! t !u f !b!n !p!v!o!u!p!gu f !wf dups!n !p!w!f !e!l!c!z!2!o!l!T!qf d!j!C!b!r!n!l!j!u!t !b!t !v!n f !e!u! bulu f !q!j!yf !r!p!gu f !d!j!s!d!r!h!n !b!s!t !n !p!w!f t !u!l!u f !u!j!b!o!h!r!h!n !b!s!t !j!o!u f !j!n , 2*.u !g!b!n f !/T!j!n !r!j!a!r!n!-!b!o!l!b!s!s!p!x !d!p!o!o!f !d!j!o!h!d!j!s!d!r!h!boe!l!d!s!p!t !t !n !b!s!t !j!o!G!h!/21D!t i !p!x! t !u f !b!n !p!v!o!u !p!gu f !wf dups!p!g!G!h!/21B!n !p!w!f !e!l!c!z!3!o!l!T!qf d!j!C!b!r!n!l!j!u!t !b!t !v!n f !e!u! bulu f !q!j!yf !r!p!gu f !d!j!s!d!r!h!n !b!s!t !n !p!w!f t !u!l!u f !l!d!s!p!t !t !n !b!s!t !j!o!u f !j!n , 3*.u !g!b!n f /

11: 7^ G!h!/22!t i !p!x! t !b!t !u!b!f !j!o!b!x i !j!d! !u !s!f !g!b!n f !j!j!o!g!s!n !j!p!o!p!g!n .u !g!b!n f -!j!n , 2*.u !g!b!n f -!boe!j!n , 3*.u !g!b!n f !b!s!f

bssboh f e!boe!t zou f t j f e!cbt f e!po!u f !ejweje!w!f dups!n pvout!t i px o!jo!Ght!21B!up!21D!Tqf dj!b!m!u f !n .u
g!bn f !jog!sn b!ypo!l!d!s!r!n!n b!s t *!j!t !bssboh f e!x!j!u p!v!boz!n p!w n f o!ubn p!v!u!u f !!n , 2*.u !g!bn f !jog!sn b!ypo!l!u!b!oh!r!n
n b!s t *!j!t !bssboh f e!jo!u f !q!pt!j!p!o!x i f s! l!u f !w!f dups!n p!w t !cz!20!-!boe!u f !!n , 3*.u !g!bn f !jog!sn b!ypo!l!d!s!p t !n b!s t *
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6 r!u!j!p!o!l!n p!o!h!u f !q!j!y f r!n!d!bo!c!f !f y!f d!v!f e!b!t !t i px o!jo!Ght!22!
\11: 8^ .b!u f !f y!b!n q!r!h!t i px o!jo!Ght!22!u f s!f .u!n f t !j!ou f sqp!r!u!j!p!o!l!t !s!f b!r!j!f e!j!o!b!w!f s!j!d!b!r!e!j!s!f d!j!p!o!-!boe!u f !j!ou f sqp!r!u!j!o!h
p!q!f s!u!j!p!o!l!o!b!i p!s!q!f p!o!u!b!r!e!j!s!f d!j!p!o!-!l!p!s!b!o!p!u f !s!w!f s!j!d!b!r!e!j!s!f d!j!p!o!l!t !f y!f d!v!f e!c!z!u f !j!ou f sqp!r!u!j!p!o!l!v!o!j!u!218!-!b!u!j!t !d!b!t f -
u f !d!p!o!w!f o!j!p!o!b!r!n f u!p!e!t !t i px o!jo!Ght!22!u!p!4!-!boe!u f !l!j!h!f !b!s!f !s!f h!b!s!e!f e!b!t !u f !j!ou f sqp!r!u!j!o!h!n f u!p!e!
\11: 9^ .Bee!j!u!p!o!b!r!n!-!j!o!u f !j!ou f sqp!r!u!j!o!h!n f u!p!e!l!b!d!d!p!s!e!j!o!h!u!p!u f !f n c!p!e!j!n f o!u!u f !q!j!y f r!j!og!sn b!ypo!l!t !o!p!u!o!f d!f t t b!s!z!
21 bssboh f e!jo!b!e!f t !j!s!f e!j!ou f sqp!r!u!j!o!h!q!p!t!j!p!o!l!n p!o!h!u f !q!j!y f r!n!d!b!u!j!t !d!b!t f -!x i f o!u f !j!ou f sqp!r!u!j!o!h!p!q!f s!u!j!p!o!l!t !b!q!q!r!i!e
v!t!j!o!h!u f !q!j!y f r!n!f y!u!b!d!f e!boe!bssboh f e!l!g!p!n !u f !p!u f !s!g!b!n f t !boe!u f !q!j!y f r!n!p!g!u f !q!s!f t f o!u!g!b!n f -!e!f t !j!s!f e!j!ou f sqp!r!u!j!o!h!p!o!
q!p!t!j!p!o!l!jog!sn b!ypo!l!t !d!b!r!v!r!u!f e!l!X i f o!b!l!q!r!m!s!b!r!j!z!p!d!t!j!m!j!n b!h!f t !b!s!f !t!z!o!u f t j f e!-!b!t !d!p!n q!b!s!f e!x!j!u !p!o!f !g!b!n f !p!d!t!j!m!
j!n b!h!f -!u f !q!j!y f r!s!f g!s!f e!l!p!o!u f !j!ou f sqp!r!u!j!o!h!p!q!f s!u!j!p!o!l!t !d!r!p!t f !s!l!u!p!u f !j!ou f sqp!r!u!j!o!h!q!p!t!j!p!o!-!t!p!u b!u!b!i!j!h i f !s!q!s!f d!j!t!j!p!o!
j!n b!h!f !d!b!o!c!f !q!s!f q!b!s!f e!
26 \11: .^ .Bee!j!u!p!o!b!r!n!-!u f !d!b!t f !x i f s!f !u f !l!i!j!h i !s!f t!p!r!u!j!p!o!l!t !s!f b!r!j!f e!c!z!l!j!ou f sqp!r!u!j!o!h!u f !q!j!y f r!n!d!b!t !c!f f o!e!f t !d!s!c!f e!l!j!o
u f !f n c!p!e!j!n f o!u!c!v!u!j!u!h!p!f t !x!j!u p!v!u!t b!z!j!o!h!u b!u!f !q!s!f t f o!u!j!ow!f o!j!p!o!l!d!b!o!t!j!n j!r!s!z!c!f !b!q!q!r!i!e!f!w!f o!x i f o!l!f o!r!s!h!f n f o!u
n b!h!o!j!b!u!j!p!o!l!d!i b!o!h!f !j!t !s!f b!r!j!f e!
\1211^ .B!t !e!f t !d!s!c!f e!l!b!c!p!w!f -!b!d!d!p!s!e!j!o!h!u!p!u f !f n c!p!e!j!n f o!u!c!z!l!f y!u!b!d!j!o!h!u f !n p!j!p!o!l!w!f d!p!s!t !g!p!s!b!l!q!r!m!s!b!r!j!z!p!d!g!b!n f t -
boe!e!j!w!e!j!o!h!u f !w!f d!p!s!t !c!z!u f !l!o!v!n c!f s!p!d!g!b!n f t -!u f !s!f t!p!r!u!j!p!o!l!t!p!g!u f !n p!j!p!o!l!w!f d!p!s!b!n p!v!o!u!p!g!u f !d!p!o!j!o!v!p!v!t !g!b!n f t
31 d!b!o!c!f !t f !u!p!o!c!f !-!o!f s!u b!o!l!p!o!f !q!j!y f r!v!o!j!u!i f s!f g!s!f -!c!z!t!z!o!u f t j f !j!o!h!u f !l!q!r!m!s!b!r!j!z!p!d!g!b!n f t !x!j!u !u f !s!f t!p!r!u!j!p!o!l!t!o!f s
u b!o!l!p!o!f !q!j!y f r!u!f !l!i!j!h i .s!f t!p!r!u!j!p!o!l!n b!h!f !d!b!o!c!f !h!f o!f s!u!f e!l!n p!s!f !f y!b!d!u!z!
\1212^ .N!p!s!f p!w!f s!b!t !d!p!n q!b!s!f e!x!j!u !x i f o!u f !n p!j!p!o!l!w!f d!p!s!t !p!g!u f !d!p!o!j!o!v!p!v!t !g!b!n f !b!s!f !d!b!r!v!r!u!f e!-!u f !l!g!f r!v!f o!d!z
p!d!p!q!f s!u!j!p!o!l!t!p!g!u f !n p!j!p!o!l!w!f d!p!s!t !j!t !s!f e!v!d!f e!-!t!p!u b!u!b!i!j!h i .t!q!f f e!l!q!s!p!d!f t!t!j!o!h!d!b!o!c!f !s!f b!r!j!f e!
\1213^ .U!i f s!f g!s!f -!t!j!o!d!f !p!o!f !g!b!n f !p!d!i!j!h i .s!f t!p!r!u!j!p!o!l!t!j!m!j!n b!h!f !j!og!sn b!ypo!l!d!b!o!l!f b!t!j!m!c!f !q!s!f q!b!s!f e!-!l!g!s!f y!b!n q!r!h!
36 g!p!n !u f !l!p!x .s!f t!p!r!u!j!p!o!l!t!j!m!j!n b!h!f !j!og!sn b!ypo!l!q!i p!u!h!s!b!q!i f e!c!z!u f !w!e!f p!d!b!n f s!b!-!boe!p!v!u!q!v!u!f e!w!y!b!u f !l!q!s!o!f s!b!o!e
u f !l!j!h!f -!u f !p!v!u!q!v!u!p!d!i!j!h i .r!v!b!r!j!z!l!j!n b!h!f t !d!b!o!c!f !s!f b!r!j!f e!l!j!o!u f !l!j!n b!h!f !q!s!p!d!f t!t!j!o!h!t!z!t!u f n !l!p!q!f s!g!s!n !d!p!n n v!o!j!d!b!u!p!o
c!f u!x!f o!u f !b!q!q!b!s!u!r!t!f t !e!j!g!f s!f o!u!j!o!q!v!u!p!v!u!q!v!u!s!t!p!r!u!j!p!o!
\1214^ .B!t!f d!p!o!e!f n c!p!e!j!n f o!u!p!g!u f !q!s!f t f o!u!j!ow!f o!j!p!o!l!x!j!m!c!f !e!f t !d!s!c!f e!l!i f s!f j!o!b!g!f s!
\1215^ .G!h!f!23!j!t !b!c!r!p!d!i !e!j!b!h!s!b!n !t i px !j!o!h!u f !l!g!v!o!d!j!p!o!b!r!v!r!u!p!o!t!j!u!v!u!p!o!l!p!g!u f !d!p!n q!v!u!s!t !u f !l!j!n b!h!f !q!s!p!d!f t!t!j!o!h!b!q.
41 q!b!s!u!r!t!p!g!u f !t!f d!p!o!e!f n c!p!e!j!n f o!u!u f !t!b!n f !d!p!o!t!j!u!v!u!p!o!l!t!u b!u!p!d!G!h!f!5!j!o!u f !t!o!u!f n c!p!e!j!n f o!u!j!t !e!f o!p!u!f e!c!z!u f
t!b!n f !s!f g!s!f o!d!f !o!v!n f s!b!r!n!-!boe!u f !e!f t !d!s!q!j!p!o!l!u f s!f p!d!j!t !p!n !u!f e!
\1216^ .U!i !j!t !t!f d!p!o!e!f n c!p!e!j!n f o!u!j!t !d!i b!s!d!u!f s!j!f e!l!j!o!u!b!u!x i f o!p!o!f !g!b!n f !p!d!t!j!m!j!n b!h!f !j!t !q!s!f q!b!s!f e!-!u!x!p!u!z!q!f t!p!g!
j!n b!h!f t!b!t!u f !d!b!r!v!r!u!j!p!o!l!p!c!k!d!u!p!g!u f !n p!j!p!o!l!w!f d!p!s!b!s!f !t!v!d!d!t!t!j!w!f !m!t!x!j!u!d!i f e!-!boe!l!g!s!i f s!t!z!o!u f t j f e!
\1217^ .b!G!h!f!23!-!b!l!d!p!v!o!u!s!t!11!d!p!v!o!u!u f !l!g!f r!v!f o!d!z!p!g!b!s!s!b!o!h!f n f o!u!c!b!t f e!l!p!o!l!f b!d!i !e!j!w!e!f e!w!f d!p!s!j!o!u f !bssboh f .
46 n f o!u!v!o!j!u!C!216/
\1218^ .B!o!l!f y!b!n q!r!h!j!o!x i !j!d!i !u f !n p!j!p!o!l!w!f d!p!s!c!f u!x!f o!u f !n .u !g!b!n f !boe!u f !!n , o*.u !g!b!n f !j!t !d!b!r!v!r!u!f e!l!j!o!u f
t!b!n f !n boof s!b!t !u f !o!u!f n c!p!e!j!n f o!u!boe!l!o.2*!g!b!n f t !l!g!p!n !u f !!n , 2*.u !g!b!n f !l!p!u f !!n , o.2*.u !g!b!n f !b!s!f !bssboh f e
c!b!t f e!l!p!o!l!f !e!j!w!e!f e!w!f d!p!s!x!j!m!o!p!x !c!f !e!f t !d!s!c!f e!
\1219^ .b!u!f !d!p!v!o!u!s!t!11!-!x i f o!u f !bssboh f n f o!u!p!g!u f !!o.2*!g!b!n f t !b!s!f !d!p!v!o!u!f e!-!l!o!p!u!b!u!j!p!o!l!t !l!s!o!b!n !j!u!f e!l!p!u!b!o
51 p!v!u!q!v!u!g!b!n f !d!p!o!u!s!r!v!o!j!u!12!l!u f !p!v!u!q!v!u!g!b!n f !d!p!o!u!s!r!v!o!j!u!12!s!f d!f !j!w!f t !u f !l!o!p!u!b!u!j!p!o!l!t!-!boe!e!f t !j!h!o!b!u!f t !u!x!p!l!g!b!n f t
b!t !u f !l!o!f y!u!n p!j!p!o!l!w!f d!p!s!d!b!r!v!r!u!j!p!o!l!p!c!k!d!u!l!g!p!n !u f !l!g!b!n f t !t!u!p!s!f e!l!j!o!b!t!u!p!s!b!h!f !v!o!j!u!13!l!q!p!s!u f !l!o!f y!u!x!p!l!g!b!n f t -
p!o!f !p!g!u f !l!q!s!f v!j!p!v!t !u!x!p!l!g!b!n f t -!u b!u!j!t -!u f !!n , o*.u !g!b!n f !t!f s!w!f t !b!t !b!s!f g!s!f o!d!f -!boe!u f !n p!j!p!o!l!w!f d!p!s!c!f u!x!f o!u f
s!f g!s!f o!d!f !boe!u f !!n , 3o*.u !g!b!n f !b!e!w!b!o!d!f e!l!g!p!n !u f !s!f g!s!f o!d!f !c!z!l!o!g!b!n f t !j!t !d!b!r!v!r!u!f e!
\121: ^ .T!v!c!t f r!v!f o!u!z!u f !q!j!y f r!bssboh f n f o!u!c!b!t f e!l!p!o!l!f !n p!j!p!o!l!w!f d!p!s!j!t !q!f s!g!s!n f e!l!j!o!u f !bssboh f n f o!u!v!o!j!u!B!215
56 boe!u f !bssboh f n f o!u!v!o!j!u!C!216!-!boe!t!z!o!u f t j f e!l!j!o!u f !t!z!o!u f t j f !j!o!h!v!o!j!u!217!-!b!u!j!t !d!b!t f -!l!j!o!u f !t!z!o!u f t j f !j!o!h!v!o!j!u
217!-!b!t!z!o!u f t j f e!l!j!n b!h!f !j!t !d!p!n q!r!h!f e!l!c!b!t f e!l!p!o!l!f !l!q!s!f v!j!p!v!t !n .u !g!b!n f !l!p!u f !!n , o.2*.u !g!b!n f !l!u f !s!f g!s!f -!u f !q!j!y f m
bssboh f n f o!u!c!b!t f e!l!p!o!l!f !!n , o*.u !g!b!n f !l!p!u f !!n , 3o.2*.u !g!b!n f !j!t !l!g!s!i f s!t!z!o!u f t j f e!l!p!o!l!f !t!z!o!u f t j f e!l!j!n b!h!f / .
\1221^ .B!t !e!f t !d!s!c!f e!l!b!c!p!w!f -!j!o!u f !t!f d!p!o!e!f n c!p!e!j!n f o!u!u f !l!j!n b!h!f t !b!e!w!b!o!d!f e!l!c!z!l!o!g!b!n f t !b!s!f !t f !s!j!b!r!m!d!p!n q!b!s!f e!l!p
p!c!u!b!j!o!u f !n p!j!p!o!l!n p!v!o!u!z!b!o!e!u f !q!j!y f r!n!b!s!f !t f !s!j!b!r!m!bssboh f e!l!c!b!t f e!l!p!o!l!f !e!j!w!e!f e!w!f d!p!s!p!c!u!b!j!o!f e!l!c!z!l!e!j!w!e!j!o!h!u f
61 n p!j!p!o!l!n p!v!o!u!z!b!o!e!l!T!q!f dj!b!m!u f !t i px o!jo!Ght!23!-!b!t!t!v!n !j!o!h!u b!u!c!j!o!e!j!d!b!u!f t !b!o!j!o!u!f h!f s!u f !n p!j!p!o!l!w!f d!p!s!j!t !p!c!u!b!j!o!f e
c!z!l!n , o!x!c*.u !g!b!n f !boe!l!n , o!x!c, 2**u !g!b!n f !boe!l!n , o!x!c, b*.u !g!b!n f !j!t !bssboh f e!l!g!s!i f w!f s!z!l!o.2*!g!b!n f t !l!c!b!t f e
p!o!l!u f !e!j!w!e!f e!w!f d!p!s!T!v!c!t f r!v!f o!u!z!u !j!t !q!s!p!d!f t!t!j!o!h!j!t !s!f q!b!u!f e!l!p!u!b!l!q!s!f e!f u!s!n !j!o!f e!l!v!q!q!f s!r!j!m !j!u!w!r!m!f !c!z!l!o!d!s!n f o!j!o!h
c!l!f b!d!i !c!z!l!p!o!f -!b!i!j!h i f !s!r!v!b!r!j!z!l!boe!l!s!f t!p!r!u!j!p!o!l!n b!h!f !d!b!o!c!f !p!c!u!b!j!o!f e!
\1222^ .B!t !e!f t !d!s!c!f e!l!b!c!p!w!f -!b!d!d!p!s!e!j!o!h!u!p!u f !t!f d!p!o!e!f n c!p!e!j!n f o!u!j!o!b!ee!j!u!p!o!l!u f !f !g!f d!u!p!c!u!b!j!o!f e!l!g!p!n !u f !o!u!f
66 f n c!p!e!j!n f o!u!u f !l!o!v!n c!f s!p!d!g!b!n f t !l!g!s!v!t f !j!o!q!s!f q!b!s!j!o!h!p!o!f !t!j!m!j!n b!h!f !j!t !j!o!d!s!f b!t f e!l!c!z!t!f !u!j!o!h!u f !l!v!q!q!f s!r!j!m !j!u!w!r!m!f !p!g
c!l!u!p!c!f !r!b!s!h!f -!u f !l!j!n b!h!f !r!v!b!r!j!z!l!b!g!f s!u f !j!ou f sqp!r!u!j!o!h!t!l!g!s!i f s!f o!i!b!o!d!f e!
\1223^ .Bee!j!u!p!o!b!r!n!-!j!o!u f !t!f d!p!o!e!f n c!p!e!j!n f o!u!u f s!f !d!b!o!c!f !q!s!p!w!e!f e!u f !l!j!n b!h!f !q!s!p!d!f t!t!j!o!h!b!q!q!b!s!u!r!t!j!o!x i !j!d!i !u f
s!f t!p!r!u!j!p!o!l!p!o!w!f s!t!j!p!o!l!c!z!c!f t!u!j!n b!h!f !r!v!b!r!j!z!l!d!b!o!c!f !s!f b!r!j!f e!l!c!z!t!f !u!j!o!h!u f !l!w!r!m!f t!p!g!o!l!c!-!l!g!s!i f y!b!n q!r!h!-!l!p!f y!q!f s!n f o!u!b!r!m

$$F(U, v) = (2/N) C(u) C(v) \sum_{m=0}^{N-1} \sum_{n=0}^{N-1} f(m, n) \cos((2m+1)ux/2N) \cos((2n+1)vx/2N)$$

... (6)

D) $q^* > 20\sqrt{3}$) $q > 1^*$

D) $q^* > 2$ $q^* = 1^*$

\1239^ Polü f !pü f !si boe-lü f !jn bhf !pgü f !)n , 2*.ü !göb f !jt !göb f !eljou!b!cprdl !jölü f !voju!pgN ×!N(!qjyf rhlcz!b!cprdl !göb joh!voju!314!l!b!jt !dbt f -l!ü f !cprdl !göb f !eljou! f !voju!pgN ×!N(!qjyf rhljodmef t !ü f !cprdl !pgO ×!O!qjyf rhlpgü f !t bn f !dppsejobü !bt !ü bulpgü f !cprdl !B!jölü f !jn bhf !pgü f !)n , 2*.ü !göb f !/ !f sf -!göslü f !t !{f !f !sf rhyü!pgN !boe!O-N !ü!O-lboe!N(!ü!O)!f ydf qüü f !dbt f !pgN!>!N(!>!O*!l!jt !opx !bt tvn f !e!ü buN!>!N(!>!31!T!qf dj!Öb!n!31 ×!31!cprdl t jodmrejoh!ü f !cprdl !pgO ×!O!qjyf rhlpgü f !t bn f !dppsejobü !bt !ü bulpgü f !cprdl !B!bs !qsf qbsf eljölü f !)n , 2*.ü !göb f !/ \123: ^ Tvct f r vf ouz!l!ü f !cprdl !pgO ×!O!qjyf rhl! bwöh!ü f !t bn f !t !{f !bt !ü bulpgü f !n , ü !göb f !jt !qsf qbsf eljölü f !cprdl !pg31 ×!31!qjyf rhlcz!b!cprdl !göb joh!voju!315!l!ü f !qsf qbsü!pgü f !cprdl !n bzlt übs!göb !ü f !t bn f !dppsejobü !bt !ü bulpgü f !cprdl !B-lpsn bzlt übs!jöl!psf !göb !ü f !f oe!pgü f !N ×!N(!cprdl !/OpX -l!ü f !cprdl !pgO ×!O!qjyf rhl!qsf qbsf eljölü f !jn bhf !pgü f !)n , 2*.ü !göb f !jt !ü obü!w!r!z!sf g sf el!p!bt !b!cprdl !C/

\1241^ Övn f !sbt!316!ef opü f !bo!psü phpböhr!söb!t gsn !voju!p!psü phpböhr!söb!t gsn !ü f !qsf qbsf elcprdl !C!jölü f !t bn f !n boof !sbt !ü f !cprdl !B!l!ü f !psü phpböhr!söb!t gsn !voju!313-!316!i bwf !p!qf gsn !ü f !psü phpböhr!söb!t gsn !x !ju !ü f !t bn f !söb!t gsn !n f !bot !/B!söb!t gsn !dpf !dj!f ouf !wömbü!pö!voju!317!f !wömbü f !t !ü f !t !jn !jrasü!pgü f !söb!t gsn !dpf !dj!f ou cbt f !elpö!ü f !psü phpböhr!söb!t gsn !dpf !dj!f out !pgü f !cprdl t !B!boe!C!Cbt f !elpö!ü f !e!sf düdvssf ou!ED*!dpn qpo!f ou!pgü ü f !cprdl !-boe!N !bjor!ü f !!pX .gf r vf odz!l!dn qpo!f ou!pgb!r sobü!oh!dvssf ou!BD*!dpn qpo!f ou!ü f !t !jn !jrasü!jt !f !wömbü f e cz!ü f !t vn !pgü f !wömbü !pcbü!jof elcz!n !v!q!r!z!oh!ü f !e!j!f sf od!f !pgü f !dpf !dj!f out !cz!b!x f !jhi !joh!dpf !dj!f ou!gösf bdi !dpn qpo!f ou/

\1242^ OpX -!p!dp!dj!r!b!f !ü f !ef t !ds!q!p!o-l!j!t !bt tvn f !e!ü bulü f !cprdl !dppsejobü !jt !n !böh!f !elcz!ü f !dppsejobü !pgü f !r!g!v!q!f !q!jyf r!g!s!n joh!ü f !cprdl !ü f !q!jyf r!h!p!p!s!e!jobü !jt !ü f !sf !jög!f !sf g sf el!p!bt !ü f !cprdl !n !böh!f n f !oudp!p!s!e!jobü */T!qf dj!Öb!n!-bt !t !px ol!o!G!h!l!27!-bt tvn joh!ü bulü f !n !böh!f n f !dppsejobü !pgü f !cprdl !C!jt !i!)b-lc*!ü f !f !wömbü!pö !v!d!p!o!p!d!ü f !t !jn !jrasü!pgü f !cprdl t !B!boe!C!jt !db!w!v!f !e!bt !g!m!x t ;

$$R(a,b) = \sum_{u=0}^{N-1} \sum_{v=0}^{N-1} (W(u,v) \times |FA(u,v) - FB(a,b)(u,v)|)$$

... (7)

blü f lf r vbüpo-X) v-w'lef opuf t lü f bx f jhi yoh!dpf gñijf oupgdpn qpof ou/v-w'-(GB)v-w'lef opuf t lü f lpsu phpobrtbot gsn
 dpf gñijf oupgü f !crpdl !B-boe!GC)b-c*)v-w'lef opuf t lü f lpsu phpobrtbot gsn !dpf gñijf oupgü f !crpdl !C!x i f olü f !n bo.
 bhf n f oudppsejobuf !jt !)!b-lc*/
 \1243^ Tjodf !ü f ldpss rñupolpgü f !usbot gsn !dpf gñijf out !pgbelbdf outcrpdl t !jt !rpx f sf eljolbli jhi f slgf r vf odz!bsf b-
 u f !wbrmf !pgü f bx f jhi yoh!dpf gñijf ouX) v-w'!t !t f up!cf !t n bñjolu f !i jhi lsf r vf odz!bsf b!/Tjodf !ü f !usbot gsn !dpf gñijf out
 pgü f !rpx !lsgf r vf odz!bsf b!pgü f !crpdl t !x i p!t f !dppejobuf t !bsf !t qbýbnñ!rpt f !up!bdi !pü f sljt !w' sz!i jhi !aldpsf rñuf e-
 jolu f lf r vbüpo!)8*-!f wbrmbüpojlt !qf gsn f elcz!sf qñadjoh!ü f !t qbýbrñqpt !qjof!sf rñüpolpgü f !crpdl t !x jü lü f !t jn jñasuz!pg
 ü f !usbot gsn !dpf gñijf out !/Npsf pwf slü f !bct pñuf !wbrmf !jt !vt f eljolü f lf r vbüpo!)8*-!cvlü f !t jn jñasf wbrmbüpo!dbolcf
 sf brñj f elf w' olx jü lü f !t r vbsf !pgü f !ejgf sf odf /
 \1244^ B!crpdl !dpousrñvuj318!n pwf t lü f !n bobhf n f oudppsejobuf !)!b-lc"!pgü f !crpdl !C!cz!pof !qjyf rñup!qsf qbsf !b
 of x !crpdl -!boe!sf qf but !t jn jñas!qspdf t !toht !up!qf gsn !dpousrñT!qf dj!Öbññ-jolu f lf ybn qñh!pgO!>!9-!N!>!N!(>!31-!t jodf
 24 ×!24!crpdl t !pg9 ×!9!qjyf rñ!dbolcf !qsf qbsf eljolü f !crpdl !pg31 ×!31!qjyf rñ-lü f !t jn jñasuz!jt !sf qf bñf enz!dbñvñuf e
 qslü f !crpdl t /

\1245^ X i f o l u f !t dboojo!pgu f !crpdl !C!jt !dpn qrfu eljo!u f !jn bhf !pgu f !n , 2*.u !gbn f -lu f !dppsejobuf !b(-lc!)jo x i jdi lu f !f wmbu!pogodupolS)b(-lc!)t !n jojn j(f e!t lef u f n jo f e/!Tqf dj!bma!t jodf lu f !jn jrasuzS)b(-lc!)dbo!cf !f hbsef e bt lu f !f spsdpn qpof oucf u f f o l u f !crpdl !B!boelC-lu f !crpdl !C!x i f o l S)b(-lc!)l u f t lu f !n jojn vn !wmbf !u j t !crpdl !jt s f g s f elu!bt !b!crpdl !C!jt !f hbsef e!bt lu f !crpdl !brp!t qb!ym!drt f t u!p lu f !crpdl !B!boel!vehf eljo!b!qpt j!p o!l u x i jdi u f !crpdl !B!n p w f t !/! p x f w f s!jo!u j t !d b t f -!t jodf lu f !f t p m!p o!l p g u f !n p!p o!l w f d!p s d p s f t q p o e t !u l u f !v o j u p d p o f !q j y f m j o l u f !t b n f !n b o o f s!b t !j o l u f !d p o w f o!p o b r f y b n q r f -l u f !n p!p o!l w f d!p s d b o o p u l c f !e f u f d u f e!x j u !b!s f t p m!p o!l x i jdi !jt r f t t !u b o l u f !c f u f f o .q j y f r e j t u b o d f /

\1246^ U i f s f g s f -!j o l u f !f n c p e j n f o u l u f !n p!p o!l w f d!p s !t !e f u f d u f e!q s f t v n f e!x j u !u f !f t p m!p o!l x i jdi !jt !t i p s f s u b o l u f !c f u f f o .q j y f r e j t u b o d f !/U i f !n f u p e!l p g e f u f d!j o h l u f !w f d!p s x j m!c f !e f t d!j c f e!i f s f j o b g f s

\1247^ J b!u f !b c p w f .e f t d!j c f e!n f u p e-l!j u j t !b t v n f e!u b u l u f !n b o b h f n f o u d p p s e j o b u f !p g u f !c r p d l !B!b t l u f !o p u f e c r p d l !p g u f !n .u !g b n f !j t !b 1-l c 1*-!b o e l u f !n b o b h f n f o u d p p s e j o b u f !p g u f !c r p d l !C!p g u f !n , 2*.u !g b n f !x i jdi !b l f t u f !n jojn vn !wmbf !p g S)b(-lc!)t !b(-lc!)l u f !u b o t g s n !d p f g!j f o u f w m b u !p o l v o j u 3 1 7 -l u f !c r p d l !C!j t !s p v h i r a!s f u f w e j o l u f !v o j u p d p j y f m c v u l u j t !n f !b!C o f l e j t u b o d f !t l e f u f d u f e!p o r m!j o l u f !k f s q i f s z !p g u f !c r p d l !C!j t q f d j!b m a!t j o d f l u f !u b o t g s n d p f g!j f o u f w m b u !p o l v o j u 3 1 7 !d b s f t !p v u x p l t u b h f t !p g f w m b u !p o t !e j g f s o u j o!d p o t u j v u j p o!;!C!t u l u f !s f u f w b r p g u f c r p d l !C!x i jdi !t f n t !u l c f !t q b!y m!d r t f t u l u f o l u f !e f u f d!p o!l p g b n j o v f !e f w b u !p o b n p v o d g p n l u f !p c u b j o f e!c r p d l !C/

\1248^ G h !/28!j t !b!C!x d i b a l t i p x j o h l u f !p q f s b u !p o!l q s d f e v s f !p g u f !t f d p o e .t u b h f !e f u f d!p o /

\1249^ J b!T 5 1 2 -l u f !f w m b u !p o l g r o d u p o!s f t v r a !p g u f !c r p d l !q s f q b s f e!p o f !q j y f r h p l u f !f h g!p g u f !c r p d l !C!b o e l u f !c r p d l q s f q b s f e!p o f !q j y f r h p l u f !f !s h i d c z !u f !f r v b u j o!;8!b s f !d p n q b s f e!/!T q f d j!b m a!t j o d f l u f !n b o b h f n f o u d p p s e j o b u f !p g u f !c r p d l !C!j t !b(-lc!)l u f !t j f f t !p g S)b(-lc!)2-l c(!b o e l S)b(-lc!)2!b s f !f w m b u f e!/!T j o d f l u f !S)b(-lc!)2-l c(!b o e l S)b(-lc!)2!b s f d b r d v r u f e!j o l u f !C!t u t u b h f !t j n j r a s u z !f w m b u !p o -l u f !p q f s b u !p o!l s f t v r a !b s f !q s f g s b c r m!t u p s f e 0 f n a /

\124: ^ T v c t f r v f o u z !j o!T 5 1 2 -l u f !f w m b u !p o l g r o d u p o!s f t v r a !p g u f !c r p d l !q s f q b s f e!b c p w f !u f !c r p d l !C!c z !p o f !q j y f m b o e l u f !c r p d l !q s f q b s f e!c f m a x !c z !p o f !q j y f r c z !u f !f r v b u j o!;8!b s f !d p n q b s f e!/!T q f d j!b m a!t j o d f l u f !n b o b h f n f o u d p p s e j o b u f !p g u f !c r p d l !C!j t !b(-lc!)l u f !t j f f t !p g S)b(-lc!)2!b o e l S)b(-lc!)2!b s f !f w m b u f e!/!T j o d f l u f !t j n j r a s u z !f w m b u !p o g r o d u p o!t !b s f !b r p !t d b r d v r u f e!j o l u f !C!t u t u b h f !t j n j r a s u z !f w m b u !p o -l u f !p q f s b u !p o!l s f t v r a !b s f !q s f g s b c r m!t u p s f e 0 f n a /

\1252^ J b!T 5 1 5 -l j g S)b(-lc!)2!j t !f w m b u f e!b t !c f j o h !t n b r m l u f !q s d f e v s f !t i j g t !u!T 5 1 6 -l b o e l j g!j u j t !f w m b u f e!b t !c f j o h o p u t n b r m l u f !q s d f e v s f !t i j g t !u!T 5 1 7 !/J b!T 5 1 6 !u f !c r p d l !p g n b o b h f n f o u d p p s e j o b u f !b(-lc!)2!j t !t f u b t !b!c r p d l !E-b o e l j o!T 5 1 7 !u f !c r p d l !p g n b o b h f n f o u d p p s e j o b u f !b(-lc!)2!j t !t f u b t !u f !c r p d l !E!B e e j u p o b r m a!j o!T 5 1 6 !b!w s j b c r h l j t t f u p l e!>!2-l b o e l j o!T 5 1 7 !j u j t !t f u p l e!>!2/

\1253^ T v c t f r v f o u z !j o!T 5 1 8 -l u f !t j f f !s f r a u j o!l p g u s f f !u z q f t !p g w m b f t !p g b!u b o t w f s f !B D!c b t j d!x b w f !d p n q p o f o u G₃)2-l!*!j o l u f !p s i p h p o b r m a!t g s n !d p f g!j f o u p g u f !c r p d l !B!b o e l u b o t w f s f !B D!c b t j d!x b w f !d p n q p o f o u !G₃)2-l!-1*-!G₃)2-l!-1*!j o l u f !p s i p h p o b r m a!t g s n !d p f g!j f o u !p g u f !c r p d l !C!b o e l u f !c r p d l !E!j t !f w m b u f e!/!T q f d j!b m a!t j u j t !f v e h f e x i f u f s!p s o p u l u f !w m b f !p g G₃)2-l!-1*!f y j t u l c f u f f o l u f !w m b f t !p g G₃)2-l!-1*!b o e l G₃)2-l!-1*!j u f !w m b f !f y j t u -l u f !q s d f e v s f !h p f t !u!T 5 1 9 -l b o e l j o p u!u f !q s d f e v s f !h p f t !u!T 5 1 : !/J b!T 5 1 9 -l b!w s j b c r h l j t !d b r d v r u f e!j o l u f !g m a x j o h !f r v b u j o /

$$y > |G_3)2-1^*.G_C()2-1^*qG_3)2-1^*.G_C()2-1^*~ \quad)9^*$$

N p s f p w f s!j o!T 5 1 : -l u f !w s j b c r h l j t !t f u p l y!>!1/

\1254^ T j n j r a s u z !j o!T 5 2 1 -l u f !t j f f !s f r a u j o!l p g u s f f !u z q f t !p g w m b f t !p g b!u b o t w f s f !B D!c b t j d!x b w f !d p n q p o f o u G₃)1-12* j o l u f !p s i p h p o b r m a!t g s n !d p f g!j f o u p g u f !c r p d l !B!b o e l u b o t w f s f !B D!c b t j d!x b w f !d p n q p o f o u !G₃)1-12*-!G₃)1-12*!j o u f !p s i p h p o b r m a!t g s n !d p f g!j f o u !p g u f !c r p d l !C!b o e l u f !c r p d l !E!j t !f w m b u f e!/!T q f d j!b m a!t j u j t !f v e h f e!x i f u f s!p s o p u l u f !w m b f !p g G₃)1-12*!f y j t u l c f u f f o l u f !w m b f t !p g G₃)1-12*!b o e l G₃)1-12*!j u f !w m b f !f y j t u -l u f !q s d f e v s f !h p f t !u!T 5 2 2 -l b o e l j o p u!u f !q s d f e v s f !h p f t !u!T 5 2 3 !/J b!T 5 2 2 -l b!w s j b c r h l j t !d b r d v r u f e!j o l u f !g m a x j o h !f r v b u j o /

$$z > |G_3)1-2^*.G_C()1-2^*qG_3)1-2^*.G_C()1-2^*~ \quad): *$$

N p s f p w f s!j o!T 5 2 3 -l u f !w s j b c r h l j t !t f u p l z!>!1/

\1255^ J b!T 5 2 4 -l u f !n p!p o!l w f d!p s !u l u f !c r p d l !s f g s f e!u!b t l u f !c r p d l !C!#!x i jdi !jt !f v e h f e!u!p l c f !s f b r m l n p w f e!g p n u f !c r p d l !B!j t !t f u c b t f e!p o l u f !d b r d v r u f e!y-l!c z !u f !f r v b u j o t !;9*-!); *!b t !g m a x t -l u f !s f c z !f o e j o h l u f !q s d f e v s f /

$$B\bar{C}\#)u f n p!p o!l w f d!p s >)b(, dYy.bP- c(, eYz.cP^ \quad)21^*$$

Tqf djÖbmræ-lu f !n pūpōlwf dupsup!u f !crpdl !C!gpn !u f !crpdl !B!jt !bt !gmpx t ;

BC(>)b(cP-c,cP*

)22*

6

Ui f sf gsf -!uf sn t !d x!y-le x!z!pgü f !f r vbūpō!)21!bsf !wf dupsdpn qpof out !x i pt f !sf t pmūpōt !bsf !i jhi f slū bolū f cf ux f f o.qjyf rñejt uodf /

\1256^ Ui f !qspdf t !joh!pgü f !bcpwf !Qpx di bsdx jmfef !ef t dšcf eljo!n psf !ef t bjrtx jū !sf gsf odf !up!Ght /!29!up!34/

21 \1257^ Gñh/!29!jt !b!ejbhsn !t i px joh!u f !dpsf rñūpō!pgü f !crpdl t !B!boe!C!Bt !ef t dšcf elbcpwf -!u f !n bobhf n f ou dppsejobuf !pgü f !crpdl !B!jt !b1-lc1*-!boe!u f !n bobhf n f ou dppsejobuf !pgü f !crpdl !C!jt !b(-c(!Opx -!u f !wf dupsup!u f crpdl !C!gpn !u f !crpdl !B!jt !spvhi rñdbrvñuf elcz!u f !Öt ut ubhf !t jn jrasuz!f vñmbūpō/

\1258^ Gñt /!2: B-!2: C!bsf lejhsn t !t i px joh!u f !dpsf rñūpō!pgü f !crpdl !C!boe!u f !crpdl t !qsf qbsf eljo!u f !qf sji f sz pgü f !crpdl !C!Gñh/!2: B!t i px t !u f !qf sji f sbrtcrpdl t !jo!b!ubot wf st f !ejf dūpō-lū buljt -!ux pluzqf t !pgcrpdl t !gpn f elcz t i jgñh!n bobhf n f ou dppsejobuf !cz!pof !qjyf rñbdi !p!u f !rñg!boe!u f !sñhi udf ouf sñh!pō!u f !crpdl !C!x i pt f !n bobhf n f ou dppsejobuf !jt !b(-c(!Gñh/!2: B-lū f !crpdl t !t rñi uzef wñb !jo!b!wf sjdbrtejsf dūpō-lcvlū jt !sf qsf t f out !u f !dpsf rñūpō!pgü f !crpdl t !p!gñdjñb!u f !u f !voef st uboejoh-lboe!u f !crpdl t !ep!opubdwbrñef wñb !jo!u f !wf sjdbrtejsf dūpō-lb!Gñt /!2: B-2: C-lū f !qjyf rñt i px olcz!t rñūjoh!rñof t !joejdbf !u f !qjyf rñ!pgü f !n bobhf n f ou dppsejobuf t !Bt !ef t dšcf elbcpwf -!f jū f s pof !pgü f t f !crpdl t !jt !t f ubt !u f !crpdl !D/

26 \1259^ Tjn jrasz!Gñh/!2: C!t i px t !u f !qf sji f sbrtcrpdl t !jo!u f !wf sjdbrtejsf dūpō-lū buljt -!ux pluzqf t !pgcrpdl t !gpn f elcz wf sjdbrte!t i jgñh!u f !n bobhf n f ou dppsejobuf !cz!f bdi !qjyf rñd! ouf sñh!pō!u f !crpdl !C!x i pt f !n bobhf n f ou dppsejobuf !jt !b(-c(!Gñh/!2: C-lū f !crpdl t !t rñi uzef wñb !jo!u f !ubot wf st f !ejf dūpō-lcvlū jt !sf qsf t f out !u f !dpsf rñūpō!pgü f crpdl t !p!gñdjñb!u f !u f !voef st uboejoh-lboe!u f !crpdl t !ep!opubdwbrñef wñb !jo!u f !ubot wf st f !ejf dūpō-lū jn jrasz!f jū f s pof !pgü f t f !crpdl t !jt !t f ubt !u f !crpdl !E!Bt !ef t dšcf elbcpwf -!u f !t f uñh!pgü f !crpdl !D!ps!E!jt !qf gpn f elcz!vñh!joh x i f u f slū f !crpdl !t !b!i jhi !t jn jrasuz!jo!ps! phpobrtñbot gpn !dpf gñj!f ou!p!u f !crpdl !B/

31 \125^ Gñt /!31-!32-!33!t i px !u f !qjyf rñbmf t !pgü f !crpdl t !B!-C!-!D!jo!u f !bduwbrñb!w!sñrñ bhf -!boe!EDU!ubot gpn dpf gñj!f out !dbrvñuf elcz!u f !f r vbūpō!)7^/

36 \1261^ !b!Gñh/!31!ovn f sñr!812!ef opuf t !u f !lñ bhf !ebub!pgü f !crpdl !B!bt !u f !opuf elcrpdl !jo!u f !n !u !gñn f !!Ui f !crpdl t !f !jt !opx !t f !up!9 x!9!qjyf rñ!Ovn f sñr!813!ef opuf t !EDU!ubot gpn !dpf gñj!f out !pgü f !crpdl !B!Ui f !crpdl !C!jo!u f !n , 2!u !gñn f !jt !sf uñf wf elcbt f elpō!u f !ubot gpn !dpf gñj!f out !813/

41 \1262^ !b!Gñh/!32!ovn f sñr!822!ef opuf t !u f !qjyf rñbmf t !pgü f !crpdl !C!x i jdi !jt !f vñmbuf elp!i bñf !b!i jhi f t !t jn jrasuz bt !b!sf t vñp!g!f uñf vñr!Ovn f sñr!823!ef opuf t !EDU!ubot gpn !dpf gñj!f out !pgü f !crpdl !C!gñsvt f !jo!u f !sf uñf vñr!Bt bqbsf ougpn !813-!823-lū f !t jn jrasuz!jt !gvoe!up!cf !i jhi /

46 \1263^ !b!Gñh/!33-lōvn f sñr!832!ef opuf t !u f !crpdl !D!x jū !u f !n bobhf n f ou dppsejobuf !pgü f !crpdl !C!n pwf elp!u f sñhi udf !pof !qjyf rñ!Ui !t !jt !f vñmbuf elbt !cf !joh!i jhi f !s!o!t jn jrasuz!u bolū f !crpdl !x i pt f !n bobhf n f ou dppsejobuf !t !b!n pwf elp!u f !rñg!cz!pof !qjyf rñboe!t f rñd!f e!Ovn f sñr!833!joejdbf t !u f !EDU!ubot gpn !dpf gñj!f out !pgü f !crpdl !D!Ui f !t jn jrasuz!cf ux f f olū f !crpdl !D!833!boe!u f !crpdl !B!813!jt !obw!sñr!rñpx f slū bolū f !t jn jrasuz!cf ux f f olū f !crpdl !C!823!boe!u f !crpdl !B!813!f sñs!jt !rñshf */

\1264^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !pgü f !EDU!ubot gpn !dpf gñj!f out !813-!823-!833!bsf !opuf e/

51 \1265^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

56 \1266^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1267^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1268^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1269^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1270^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1271^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1272^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1273^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1274^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1275^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

\1276^ !f sf -!up!t zōu f t !j!f !u f !crpdl !B!jo!u f !t qbdf !cf ux f f olū f !qjyf rñ!pgü f !crpdl !C!boe!u f !crpdl !D!ef wñb!joh!cz pof !qjyf rñ!u f !bssboh!n f ou qpt jūpō!t !b!p!cf !ef u sn jof elx jū jo!u f !cf ux f f o.qjyf rñejt uodf !!Ui f o-lbt !ef t dšcf eljo!u f Qpx !pg!Gñh/!28-lū f !ubot wf st f !BD!cbt !jd!x bñf !dpn qpof out !bsf !#47/48!jo!813-!#46/61!jo!823-!boe!#52/57!jo!833-lū f qpt jūpō!t !f t !ñ bñf elcz!n vñbñrñdpn qbsñh!u f !dpn qpof out !Tqf djÖbmræ-lūjt !qsf t vn f elū buli f !cbt !jd!x bñf !dpn qpof ou rñof bñrñ!t i jgt !jo!qspqps!jo!p!u f !t !qjybñejt uodf /

y >)47/48.46/61*Q52/57.46/61* A 1/26

61 Tqf djÖbmræ-lūjt !lwehf elū buli f !n bobhf n f ou dppsejobuf !pgü f !crpdl !C!jt !qpt jūpōf el!buli f !sñhi upgü f !n bobhf n f ou dppsejobuf !pgü f !crpdl !C!cz!1/26!qjyf rñ

\1266^ Bt !ef t dšcf eljo!u f !Qpx !pg!Gñh/!28-lx i f olū f !ubot wf st f !cbt !jd!x bñf !dpn qpof out !pgü f !crpdl t !C!-!B!-!D!ep!opu n popupovt rñ!jodsf bt f !ps!ef dšf bt f -!lūjt !lwehf elū buli f !dppsejobuf !jt !jo!u f !t bn f !qpt jūpō!t !u bulpgü f !dppsejobuf pgü f !crpdl !C!jo!u f !ubot wf st f !ejf dūpō/

66 \1267^ Tjn jrasz!gñs!u f !wf sjdbrtejsf dūpō-lū f !wf sjdbrtejt uodf !z!gpn !u f !crpdl !C!jt !dbrvñuf el!bt t vn joh!u buli f bssboh!n f oujt !rñof bñp!u f !di boh!f !bñp!pgü f !wf sjdbrtejt !jd!x bñf !dpn qpof out

\1268^ Gñh/!34!t i px t !bolf ybn qñ!p!gqpt jūpōbñsf rñūpō!pgy-lz!gpn !u f !n bobhf n f ou dppsejobuf !pgü f !crpdl !C!-!boe

[illegible]

$$R(a, b) = \sum_{m=0}^{N-1} \sum_{n=0}^{N-1} |IB(a, b)(m, n) - IA(m, n)|$$

... (12)

.b!u f !f r vb!ypo-(b-c)*n -o*!ef opuf t !b!qjyf r!wbrmf !jolu f !c!rpd! !C!-boe!b) n -o*!ef opuf t !b!qjyf r!wbrmf !jolu f !c!rpd! !B/
 \1278^ .b!u f !t bn f !n boof s!bt !u f !c!rpd! !dpousr!v!ouj318!pgGh/\26-!b!c!rpd! !dpousr!v!ouj323!s' qf bt !b!t f s!f t !pg
 pqf s!b!p!t !dpn qst johl!t d!boojohl!u f !jot jef !pgu f !N >!(qjyf r!c!rpd! !jolu f !v!ouj!pgpof !qjyf r!q!s' qbsjohl!b!of x !c!rpd! !boe
 f !wbrmb!yohl!b!ej!s' odf !/T!vct f r v f ouz!b! x i f !olu f !t d!boojohl!t !dpn q!rnf e-l!u f !c!rpd! !C!j!ox! i jdi !u f !wbrmf !pgS)-b-c*!jt
 n jojn !j f e!lj!t jef s' f on e!bt !u f !c!rpd! !C/
 \1279^ U! f !n f !u p!e!pgef u d!johl!u f !n p!p!olw d!ps!jolu f !s' br!t q!b!f !jt !t jn j!r!s!up!u f !f n q!r!uf !n b!d! johl!t f e!jolu f
 C!t u!p!u j!e!f n c!pejn f ou -!boe!u f !ef u!r!ne!ef t d!sq!p!olu f s' p!dj!t !pn j!uf e/
 \127: ^ X i f !olu f !ef u!f n jo!y!p!u!pgu f !c!rpd! !C!(!t !dpn q!rnf e!p!olu f !s' br!t q!b!f -!u f !n jo!v! !ef v!y!p!o!bn p!v!oub!sp!v!oe
 u f !c!rpd! !C!(!t !j!ow!s!t !t !jn b!t e!/!U f !p!s! p!h!pob!r!s!bot g!sn !v!ouj313!jt !f !b!t !g!s!b!q!q!z!johl!u f !p!s! p!h!pob!r!s!bot g!sn !pg
 u f !c!rpd! !B!/!Tjn j!r!s!u!u f !p!s! p!h!pob!r!s!bot g!sn !v!ouj316!jt !f !b!t !g!s!b!q!q!z!johl!u f !p!s! p!h!pob!r!s!bot g!sn !pgu f !c!rpd! t
 x i jdi !i p!s! p!ow!r!boe!w!f s!j!d!r!e!f v!y!uf !cz!p!of !qjyf r!g!sn !u f !n bob!hf n f ou!d!p!p!s!ej!ob!t !t !pgu f !c!rpd! t !C!(!boe!C!/\b!b
 u!b!t g!sn !dpf g!j!f ou!f !wbrmb!ypo!v!ouj324-l!u f !n p!p!olw d!ps!x!j!u !jolu f !cf u!f f o.qjyf r!e!jt u!b!d!t !jt !d!br!v!r!uf e!c!bt f e!p!o
 u f !u!b!t g!sn !dpf g!j!f ou!t !pgu f !c!rpd! t !b!d!p!p!s!ej!oh!p!u f !C!x di b!s!p!gGh/\28/
 \128!^ Bt !ef t d!s!cf e!bc!pw!-!jolu f !C!i !f n c!pejn f ou!lx p!t u!hf t !pg!f t !jn v!y!p!o!pg!b!of d!f t t b!z!n p!p!olw d!ps!dpn q!st f
 b!C!t ut u!hf !pg!ef u d!p!ol!cz!u f !s' br!t q!b!f -!boe!b!t f d!poe!t u!hf !pg!ef u d!p!o!cz!u f !p!s! p!h!pob!r!s!bot g!sn !dpf g!j!f ou

- t plü bdu f !t qf f elpgü f !qspdf t t joh!pgü f !gvsü !f n cpejn f oudbo!cf !jodsf bt f e/
- 1282^ Gpsü f !pqf sbüpo!pgü f !n püpo!wf dups!vt joh!ü f !bcpwf .ef t dšcf e!psü phpobrtšbot gsn -!ü f !qsf qbsbüpo!pgü f !i jhi .sf t pmiüpo!t jn!n bhf !gpn !ü f !px .sf t pmiüpo!n püpo!jn bhf !i bt lcf f olef t dšcf eljolu f !gvsü !boel!ü !f n cpe. jn f out -!cvluü jt !ü di ojr vf !dbo!obwšbm!cf !vt f eljolu f !n püpo!dgn qf ot büpo/
- 6 1283^ Nps pfw slü f !f ybn qrf!pgdbrv!büpo!pgü f !f t yn bü elcf ux f f o.qjyf rfej!t uodf !y-lz!pox!xü !ü f !sbüpo!pgü f cbtjd!x bwf !dgn qpf ot !i bt lcf f olef t dšcf e-lcvluü jt !it !opüjm juf e! !Jjt !obwšbm!cf !wehf !ü f !ejt uodf !joi!dgn qpt juf n boof slt joh!pü f !sBD!dgn qpf ot -!boe!ED!dgn qpf ot !dbo!bnp!cf !vt f e/
- 1284^ Gvsü f !sn psf -!jolu f !gvsü !boel!ü !f n cpejn f out -!ü f !dpoüjovpvt !jn bhf t !pgü f !n .ü !gbn f !boelü f !n , 2*.ü !gbn f !i bwf !cf f olef t dšcf e-lcvluü f !n püpo!wf dups!dolt !n jrtšz!cf !ef t dšcf hšerht t !pgdpoüjovpvt !psajt dpoüjovpvt jn bhf t !Tqf d!Öbzm!ü f !n püpo!wf dups!cf ux f f olü f !n .ü !gbn f !boelü f !n , 0*.ü !gbn f !i !o p!2!dbo!obwšbm!cf !t zo. ü f t j!f elvt joh!ü f !ü di ojr vf !pgü f !gvsü !ps!ü !f n cpejn f ou
- 21 1285^ Bt !ef t dšcf e!bcpwf -!jolu f !gvsü !boel!ü !f n cpejn f out -!cz!dgn qbsjoh!ü f !psü phpobrtšbot gsn !dpf üjif out cf ux f f olü f !pck ducrdl t !pgü f !gbn f t -!ü f !sf t pmiüpo!pgü f !n püpo!wf dups!bn pvoupgü f !dpoüjovpvt !gbn f t !dbo!cf t f dups!cf !Öf slü bolpof !qjyf rivoj!Cz!t zou f t j!joh!b!qmsbüw!pgdgn f t !xü !ü f !sf t pmiüpo!Öf slü bolpof !qjyf m! jhi .sf t pmiüpo!jogn büpo!dbo!cf !qsf qbsf e/
- 26 1286^ Nps pfw slcz!dgn cjojoh!ü f !n bdi joh!qspdf t t joh!polü f !sf brt qbdf -!ü f !f oi bodf n f ou!pgqspdf t t joh!t qf f e !t !bou!qbf e-lboelü f !qspdf t t joh!dbo!cf !f yf dvf e!bub! jhi !t qf f e/
- 1287^ Gh/!36!jt !b!crpdl !ejhšbn !t !px joh!ü f !jn bhf !qspdf t t joh!bqqbsbw!t !bddpsejoh!up!b!t jyu !f n cpejn f ou!ü f dpo!üv!joh!f rfn f out !t !jn jrtšz!ü !t f !pgü f !gvsü !f n cpejn f out !px oljo!Gh/!25!bsf !ef opf elcz!ü f !t bn f !ovn f šbm-boelü f !ef t dšq!polü f !sf p!jt !pn juf e/
- 31 1288^ !ü f !t jyu !f n cpejn f ou!ü f !sf !jt !qspwef e!b!ebub!qspdf t t joh!voju235!x !jdi !qspdf t t f t !ü f !qjyf rtwbm!f !p bebbü f !jn bhf !jogn büpo!pgü f !n .ü !gbn f !x f rmp!ü f !jn bhf !jogn büpo!pgü f !n , 2*.ü !gbn f !i !ü !t !ebub!qspdf t t joh voju235!gn t !b!rshf !di bsdüf št !d!pgü f !t jyu !f n cpejn f ou
- 1289^ Üi f !pqf sbüpo!pgü f !ebub!qspdf t t joh!voju235!vt joh!ü f !n püpo!wf dups!x !jdi !i bt !bsf t pmiüpo!rht t !ü bolü f qjyf rfej!t !pvuvuf elcz!ü f !n püpo!wf dups!pqf sbüpo!voju226!x jmtcf !ef t dšcf e!i f !sf jobgf šjolef !bjh
- 36 128: ^ Gh/!37!jt !b!crpdl !ejhšbn !t !px joh!ü f !ef !bjr!el!dpo!üv!büpo!pgü f !ebub!qspdf t t joh!voju235/
- 1291^ !ü !Gh/!37-!bdppsejoh!ü f !n bobhf n f ou!voju221!n bobhf t !ü f !qpt jüpo!pgü f !n , 2*.ü !gbn f !p!x !jdi !ü f !crpdl pgü f !n .ü !gbn f !jt !p!n pwf !joi!bddpsebodf !xü !ü f !wf dups!dbrv!büw! elcz!ü f !n püpo!wf dups!pqf sbüpo!voju226!Üi f dppsejoh!ü f !n bobhf n f ou!voju221!pvuvu !ü f !beesf t t !joh!x !jdi !ü f !f vbm!büpo!grodüpo!pgü f !f r vbüpo!8*!jt !ü f !n jo. jn vn !Bo!O x!O!crpdl !gn joh!voju2213!gn t !ü f !jn bhf !pgü f !n .ü !gbn f !jolu f !voju!p!O x!O!qjyf r!v!Bo!psü phpobm-šbot gsn !voju2214!psü phpobm!šbot gsn t !ü f !crpdl f !jn bhf !jogn büpo!X !f olf bdi !voju! pret !ü f !psü phpobrtšbot . gsn !jogn büpo!pgü f !crpdl !t vck ducrdl !vt f eljolu f !qsf vjpv!t .t uhf !n püpo!wf dups!pqf sbüpo!voju226-!ü f !ebub qspdf t t joh!voju235!epf t !op!of f el!p!qf gsn !ü f !qspdf t t joh/
- 41 1292^ Tjn jrtšz!-!bo!O x!O!crpdl !gn joh!voju2215-!boel!bo!psü phpobrtšbot gsn !voju2216!f yf dvf t !ü f !gn joh!pgü f !crpdl !pgü f !O x!O!qjyf rivoj!pgü f !n , 2*.ü !gbn f -!boelü f !psü phpobrtšbot gsn !qspdf t t joh!cbt f el!polü f !beesf t t sf df jwf !gn !ü f !dppsejoh!ü f !n bobhf n f ou!voju2212!X !f olf bdi !voju! pret !ü f !crpdl !i bwjoh!ü f !n join vn !f vbm!büpo grodüpo-!boelü f !qf šqi f !šbm!psü phpobrtšbot gsn !jogn büpo!bn poh!ü f !crpdl t !pck ducrdl t !qsf qbsf e!boel!f vbm!bf e jolu f !qsf vjpv!t .t uhf !n püpo!wf dups!pqf sbüpo!voju226-!ü f !ebub!qspdf t t joh!voju235!epf t !op!of f el!p!qf gsn !ü f qspdf t t joh/
- 46 1293^ Tvctf r v f ouz!-!bo!psü phpobrtšbot gsn !dpf üjif ou!gn joh!voju2217!gn t !blof x !šbot gsn !dpf üjif ou!gn ü f !psü phpobrtšbot gsn !dpf üjif out !pgü f !t vck ducrdl !pgü f !n .ü !gbn f !boel!b!qmsbüw!pgpck ducrdl t !pgü f !n , 2*.ü !gbn f !i !ü !t !psü phpobrtšbot gsn !dpf üjif ou!gn joh!voju2217!jt !pof !pgü f !di bsdüf št !d!pgü f !t jyu !f n cpejn f ou
- 1294^ Boljowf sf f !psü phpobrtšbot gsn !voju2218!jowf sf f !šbot gsn t !ü f !of x !qsf qbsf e!šbot gsn !dpf üjif ou!boe dpowf slü f !dpf üjif ou!p!ü f !qjyf rtwbm!f !pgü f !sf brt qbdf /
- 51 1295^ Üi f !bcpwf !jt !b!t f šf t !pg!Q!x t !pgü f !ebub!qspdf t t joh!pgü f !t vck ducrdl /
- 56 1296^ Gh/!38!jt !b!Q!x di bult !px joh!b!Öt !f n cpejn f ou!pgqf sbüpo!qspdf evsf !pgü f !psü phpobrtšbot gsn !dpf üjif ou gsn joh!voju2217/
- 1297^ Opx -!ü f !t vck ducrdl !pgü f !n .ü !gbn f !jt !t f !up!crpdl !B-!ü f !crpdl !i bwjoh!ü f !n join vn !f vbm!büpo grodüpo!pgü f !n , 2*.ü !gbn f !jt !t f !up!crpdl !C(-!boelü f !crpdl !x !pt f !f vbm!büpo!grodüpo!jt !f vbm!bf elbt lcf joh!t n bmn jt !t f !up!crpdl !D!pvüpg!x !crpdl t !gn f elcz!t !jgoh!cz!pof !qjyf r!jolu f !i !ps!f !poubrtejsf düpo!p!ü f !f !f !p!sü f !šhi dvt joh ü f !crpdl !C!bt !b!sf g sf odf !Tjn jrtšz!ü f !crpdl !x !pt f !f vbm!büpo!grodüpo!jt !f vbm!bf elbt lcf joh!t n bntjt !t f !up!crpdl E!pvüpg!x !crpdl t !gn f elcz!t !jgoh!cz!pof !qjyf r!v!x bse!p!sepx ox bse!jolu f !f !f !s!dbrtejsf düpo!vt joh!ü f !crpdl !C!bt ü f !sf g sf odf !Nps pfw slü f !crpdl !x !jdi !i bt !y!dppsejoh!ü f !pgpšhjo!pgü f !crpdl !D-!boel!z!dppsejoh!ü f !pgpšhjo!pgü f !crpdl !E!bt !jt !ps!h!jolt !t f !up!crpdl !F!Üi f !crpdl !F!ef vjbf t !gn !ü f !crpdl !C!f bdi !cz!pof !qjyf r!jolu !i !ps!f !poubrtboe wf !s!dbrtejsf düpo!t /
- 61 1298^ Nps pfw slü f !psü phpobrtšbot gsn !dpf üjif out !pgü f !crpdl t !bsf !t f !up!G₃-G₂-G₁-G₀-G₀-G₀-boelü f !dgn qpf out !pgü f !šbot gsn !dpf üjif ou!bsf !sf qsf t f ou!el!jolu f !gn !pg!x p.ejn f ot !jpbtrtššboh!f n f ou!j!p!sef !gn !wf !s!dbrt!ü f o !ps!f !poubrtššboh!f n f ou!Gps!f ybn qrf!-G₃!4!6!joejdbuf t !ü f !psü phpobrtšbot gsn !dpf üjif ou!pgb!ü !jse!dgn qpf ou!j
- 66

u f !w# sjdbrtjz.byjt *!ejš dýpo!pgú f !crpdl !B!boe!l!Gú ldpn qpof oujo!u f !i psj(poubrtjy.byjt *!ejš dýpo!boelj!t !ú f !t bn f
bt !G₆)6-!4 *šš qš f t ouf eljo!u f !ddpsejobuf !gšn /!Npsš pwf slú f !psu phpobrhšbot gšn !x jntcf tef t dšcf eljo!u f !f ybn qrn
pgEDU!pg9 ×!9!djyf r/v
!1299^ _b!Gh/!38-!T2312-!T2313!joejdbuf !ú f !jojýbrñ!býpo!pgwšbscbrft -!jox !jdi !ú f !wšbscbrñ!j!pgwf sjdbrtjš dýpo!boe
u f !wšbscbrñ!pgdi psj(poubrtjš dýpo!bšf !jojýbrñ f e!p!#1#!T!vct f r vf ouz!lújt !kvehf e!jo!T2314!x !i f !f špsopolu f !wbmf
pgwšbscbrñ!j!ps!kjt !rnt t !ú bo!gvš!t!jZFT-!ú f !gmpx joh!pqf šýpoj!jt !qf gšgn f e!jo!T2315/

$$G_L(y^k) \geq 2 \cdot y(\bullet) \cdot 2 \cdot z(\bullet) \cdot G_C(y^k, y(\bullet))$$

21

$$\cdot) 2. z(* \cdot G_D \vee \wedge K,) 2. y(* \cdot z(* G_E \vee \wedge K, y(* \cdot z(* G_F \vee \wedge K$$

)24*

129: ^ Jb!u f l f r v b y p o ! G V A K ! j o e j d b u f t ! u f ! p s i p h p o b r h u b o t g s n ! d p f g d j f o u l p g o f x n a l q s q b s e l c r p d l ! L ! d p n q p o f o u
 V A W ! N p s p w f s y (- l z (j o e j d b u f t ! u f ! e j t u b o d f ! u l u f ! j o u f s q r h u j p o ! q p j o u d g s n ! u f ! p s h j o ! p g u f l c r p d l ! C ! T q f d j C i b r n e ! u f ! s f
 26 b s f ! s f n b s l b c r n g ! x ! d b t f t ! j o ! x ! j d i ! u f ! l d p p s e j o b u f ! p d y - l z ! d b r d r u f e l c z ! u f ! f r v b y p o t ! i 9 * -) : * ! d p n q r h u f n a l b h s f t ! x j u
 u f ! e f t j s f e l j o u f s q r h u j p o ! q p j o u ! B d u b r n e ! j o u f s q r h u j p o ! j t ! q f s p s n f e l p o l u f ! l d r n t f t ! u j o u f s q r h u j p o ! q p j o u y (- l z (c b t f e l p o l u f
 d b r d r u f e l w b r f ! p d y - l z ! ! b i p u f s l x p s e t - l y (- l z (g s n t ! u f ! p s h j o ! p g u f l c r p d l ! L /
 12: 1 ^ U i f ! f r v b y p o ! 24 * ! s f q s f t f o u ! j n o f b s j o u f s q r h u j p o ! j o l x ! j d i ! u f ! p s i p h p o b r h u b o t g s n ! d p f g d j f o u l p g u f t ! p g u f t
 t b n f ! d p n q p o f o u ! p d g v s l c r p d l t ! G e (- l G e - l G e ! p g u f !) n , 2 * ! u g s n f ! b s f ! d b r d r u f e l c z ! u f ! e j t u j c v j p o ! s h u j ! g s u f
 31 d p p s e j o b u f ! y - l z ! T q f d j C i b r n e ! u f ! ! u b o t g s n ! d p f g d j f o u j t ! j o u f s q r h u f e l j n o f b s z l u ! u f ! e j t u b o d f ! j o ! u f ! s f b r h q b d f ! f w o l p o
 u f ! p s i p h p o b r h u b o t g s n ! b y j t /
 12: 2 ^ T v c t f r v f o u z ! u f ! w b s j b c r n ! k j t l d p v o u f e l v a l j o ! T 2316 - l b o e l j u j t ! l w e h f e l j o ! T 2317 ! x ! f u f ! s p s o p u l u f l c r p d l l i p s j .
 { p o u b r t d p n q p o f o u ! b s f ! d p n q r h u f e l / L J Z F T - l u f ! k s p d f t t j o h s f w s o t ! p ! T 2314 / L J O P - l u f ! w b s j b c r n ! j j t l d p v o u f e l v a l j o ! T 2318 /
 J j t ! l w e h f e l j o ! T 2319 ! x ! f u f ! s p s o p u l u f l c r p d l ! w f s j d b r t d p n q p o f o u ! b s f ! d p n q r h u f e l / L J Z F T - l u f ! k s p d f t t j o h ! s f w s o t ! p /
 36 T 2313 ! / L J O P - l j u j t ! l w e h f e l u b u m f ! 5 ! d p n q p o f o u ! b s f ! k s p d f t t f e - l u f ! s f c z l f o e j o h ! u f ! k s p d f t t j o h /
 12: 3 ^ P o l u f ! p u f ! s i b o e - l j O P ! 5 ! d p n q p o f o u ! b s f ! k s p d f t t f e - l b o e l u f ! k o n p x j o h
 p q f s h u j p o ! j t ! u f ! s f g s f ! y f d v f e l j o ! T 231 : /

$$G_L \psi^A > G_B \psi^A$$

)25*

41

\12: 4^ Tqf dJdmbn-lu f lpsi phpbobrhobot gsn ldpf qdjif oulpgu f !n .u !gsbn f ljt lt vct yjwv eljo!u f !! jhi !gf r vf odz!bsf b/
 \12: 5^ Btt f gsf t !pgdqsdft tt joht lbsf !t di n byjdbm!t i px oljo!Gh/139/
 \12: 6^ Jb!Gh/139-lovn f sbm!2412-12413-12414-12415!joejdubf !crpdl t !Gc(-!Gp-!Ge-!Gf-!bgf slu f !psi phpbobrhobot gsn !pg
 u f !crpdl t !C(-D-E-F!/Qpsajpot !ti px olczlt rhojohlrjof t !bsf !ED!dpn qpof out -!boe!shji ux bselboe!epx ox bselqpsajpot !pg
 u f !crpdl t !joejdubf !BD!dpn qpof out !lo! jhi !gf r vf odz!bsf bt !/Opx-lu f !usbot gsn ldpf qdjif oulpgu f !ED!dpn qpof ouboue
 26!BD!rnx .gf r vf odz!dpn qpof out !jt !qs qbsf e!czlu f !jouf sqprujopolcbt f elpolu f !usbot gsn ldpf qdjif out !pgu f !t bn f
 dpn qpof out !pgu f !gvslcrpdl t !t i px olcz!cpmlrjof t !jo!Gh/139"!Ui f !qs qbsf elusbot gsn ldpf qdjif oulpg27!dpn qpof out
 jt !t px olcz!2416/
 \12: 7^ Potu f !pu f sli boe-lps59!jhi .gf r vf odz!dpn qpof out -lu f li jhi .gf r vf odz!bsf b)cpmlrjof "bgf slu f !psi phpbom
 usbot gsn !)Gp"!pgu f !crpdl !B!t i px olcz!2417!jt !vt f e!i!Ui f !usbot gsn ldpf qdjif oulpgu f !vt f e!i jhi .gf r vf odz!bsf bljt
 t i px olcz!2418!/T vct f r vf ouzn-lu f !rnx .gf r vf odz!bsf b2416boe!u f li jhi .gf r vf odz!bsf b2418bsf !dpn cjoj elupqs qbsf
 b!of x !crpdl !L!)G_ "!2419/
 \12: 8^ Ui f lof ydef t dsjqupo!x jmtcf !cbt f elpolu f !bdwbrijn bhf lebu!t i px oljo!Ght /!3: !tp!45/
 \12: 9^ Gh/!3: !t pxt !ijn bhf !ljogsn bypo!842!pgu f !crpdl !B!bt !u f !opuf e!crpdl !pgu f !n .u !gsbn f -!boe!usbot gsn
 dpf qdjif ouljogsn bypo!843!pgu f !psi phpbobrhobot gsn !EDU"/!Nps pfw s!Gh/!41!t i pxt !ijn bhf !ljogsn bypo!852!pgu f
 crpdl !C(!pgu f !n , 2*.u !gsbn f !boe!usbot gsn ldpf qdjif ouljogsn bypo!853!pgu f !psi phpbobrhobot gsn !EDU"-!Gh/!42
 t i pxt !ijn bhf !ljogsn bypo!862!pgu f !crpdl !D!boe!usbot gsn ldpf qdjif ouljogsn bypo!863!pgu f !psi phpbobrhobot gsn
)EDU"-!Gh/!43!t i pxt !ijn bhf !ljogsn bypo!872!pgu f !crpdl !E!boe!usbot gsn ldpf qdjif ouljogsn bypo!873!pgu f !psi phpbom
 usbot gsn !EDU"-!boe!Gh!44!t i pxt !ijn bhf !ljogsn bypo!882!pgu f !crpdl !F!boe!usbot gsn ldpf qdjif ouljogsn bypo!883!pg
 u f !psi phpbobrhobot gsn !EDU"/
 \12: : ^ Opx-lx i f oljljt !btt vn f elu bulu f !forash n f oulsbjp!jt !gvsljn f t >!gvsljn f t -lu f !jouf sqprujopo!qpjouljt !qpt j.
 ypof eljo!bl!dspt t ln bs !pgGh/!46!czlu f !sbyp!pgu f !psi phpbobrhobot gsn ldpf qdjif out !pgu f !crpdl t !Tqf dJdmbn-ly!(>!z(
 >126-boe!75!qyjf rnljolu f !crpdl !bsf !bssohf elvt joh!u f !qpt jypo!pgdspt t ln bs !bt !u f !psjhjo!pgu f !crpdl !L/
 \1311^ Gh/!45!t i pxt !st t vnd !892!pgubot gsn kdpf qdjif oulsqf qbsbypo!pgu f !crpdl !L-!boe!jow sf !psi phpbobrhobot gsn
 ldpf odz!louf sqprujopot t vnd !pg853!pgGh/!41-!863!pgGh/!42-!873!pgGh/!43!boe!883!pgGh/!44!bsf !t vct yjwv e!/Nps pfw s

gslu f li jhi .gfr vf odz!bsf b!pg893!pgGh/!45-lu f !ubot gsn !dpf gduj ouwbwv !pgu f li jhi .gfr vf odz!bsf b!pg843!pgGh/3: lit lt vct uuuf e/

1312^ Npsf pwf s!bt !bqqbsf oulgn !u f !jowf sf !psi phpobrhobot gsn !jogsn bypo!893!pgGh/!45!boe!852!pgGh/!41-
f wf olx i f olu f !jogsn bypo!pgu f !n .u !gnb f !jt !t zou f !tj{f elx ju !u bu!pgu f !n , 2*.u !gnb f -!u f z!bsf !bebqf elx ju pvu
boz!ejt psef s'

11313^ U i f l t z o u f t j t ! p g b ! q m s b r j z ! p g j n b h f t ! c z ! q s f q b s j o h l u f ! p s u p h p o b r h u b o t g s n ! d p f d j i f o u t l i b t ! c f f o l e f t d s j c f e b c p w f - l b o e l u f ! l j e f b ! p g u j t ! f n c p e j n f o u r j t f l j o l u b u b l d p n q r n u f z o f x ! c r p d l j t ! q s f q b s e l p o l u f ! p s u p h p o b r h u b o t g s n b y t l c b t f e p o b b q m s b r j z b g e j f f o u t u n j n b h f k r p d t ! / t q f d j o b r h u f i f n p t u v t f g r f o g s n b u p o j o t z o u f t j j o h b q m s b r j z p g j n b h f t j t l j h i . g f r v f o d z l j o g s n b u p o ! G o s l u f ! E D ! d p n q p o f o u t ! b o e l B D l r p x . g f r v f o d z l d p n q p o f o u t - f w f o l j b q m s b r j z p g j n b t l b f M t f e - l u f z l e p b p u q s f t f o u w f z o f d f t t b s z j o g s n b u p o ! C f d b v t f l u f l d p n q p o f o u t b f w f z j h i m d p s f r u f e / P o l u f l p u f s l i b o e - l u f l j h i . g f r v f o d z l j o g s n b u p o j e j f f s t b j u f f b d i l g o n f l o s v t f l d p n q p o f l p g b j n j o v l e f w y b u p o l e v s j o h q o d j o h l v a p s l j o q v u j o h ! / U i f ! v u n j u p o l p g u f ! e i j f f o u l j o g s n b u p o l j t l i p q j o u p g j n b h f ! r v b r j z f o i b o d f n f o u

1314^ j!ú f l q s t f o u f n c p e j n f o u t j o d f l ú f l i j h i . g f r v f o d z ! d p n q p o f o u ! b s f ! t z o u f t j { f e l x j u l ú f ! p x . g f r v f o d z b s f b l p g u f ! p u f s t j m j n b h f t - l ú f ! d p n q p o f o u ! d b o l f g u j f o u z ! c f ! v j j f e l g s l u f l f o i b o d f n f o u p g j n b h f ! r v b j m x j u p v u x b t j o h l ú f l o f d f t t b s z ! j o g s n b j p o /

11315^A Npsf pwf s'johi f bcpw' lef t dsqjpo-hi f t zou f t j t p'gux p'g'bn f t p'g'n bhf t i bt kcf f o'jmt usuf e-lvuczf qf b'joh
 b'f t s'j f t p'gqspdf t t j'oh t l'gsf bdi p'gdpo'jovpvt l'g'bn f t -l'ü f lo'vn cf sp'g'g'bn f t l'p'cf ! t zou f t j f e'j t l'j'odf bt f e-lt p'li b'ub
 i j'hi f s'f t p'm'j'ol t y'm'j'n bhf ! d'bo'cf t q'sf q'bf e' ! b'ü j t ! d'bt f -l'j'gt zou f t j t j'og'gn b'j'ol t ! op'u'qpt j'j'op'f e' ! jo'ü f ! e'f t j'sf e
 j'ouf s'q'r'p'j'yo' ! p'j'j'ou'ü f ! q'j'j'f r'w'bf p'g'ü f j'j'ouf s'q'r'p'j'yo' ! p'j'j'ouf j'j'ouf s'q'r'p'ü e'cz'j'ouf s'q'r'p'j'oh' ! n f bot ! !ü f ! n f ü p'el t ! p'x o
 ! !Ght ! !2 ! w'p'4 d'bo'cf lvt f e' ! bt ! f j'j'ouf s'q'r'p'j'yo' ! n f bot !

\1316^ Gh/!47!lt !b!Qpx di bs!t i px joh!b!t f wf ou! !f n cpein f oupgu f !qsf t f oujowf oupo/

1317^ Jb!ú f lt f w ou! n cpejn f ou!porm!ú f lqspdf t t joh!jolu f lpsu phpobrbxbot gsn !dpf g!jif ou!gsn joh!voju2217!pg
ú f lt!jvú lf n cpejn f ou!t!e!qf sf ou!boe!ú f l!pú f svoju!bsf l!dnn n po/

1318^ ج!Gh/47-!T3212-!T3313!i px !ú f !jojúbñf býp!pgwbsjbcfrf -!boe!wsjbcfrf!j!pgwf sjdbrtejsf dýp!boe!wsjbcfrf!k
pgi psf powbrtejsf dýp!bsf !jojúbñf f e!up!qspwef !#1#

\1319^ Tvctf r v f ouz!u f !ompx joh!paf sbupol!t!af spsn f e!jo!T3214/

$$G(y^k) \leq 2y^k + 2z^k - G(y^k, y^k)$$

$$\cdot)2.z(*G_D \vee \wedge K), 2.y(*z(*G_E \vee \wedge K), y(*z(*G_F \vee \wedge K) \quad)26^*$$

\\131: ^ Tvctf r v f ouzlj0!T3215-lu f !pmx joh!pqf sbupoljt !qf spsn f e/

$G \setminus \Gamma K > b \setminus \Gamma K \cdot G \setminus \Gamma K, c \setminus \Gamma K \cdot G \setminus \Gamma K$)27*

11321^ I f s - b y A K - c y A K b s ! d p f g d j f o u - l x i j d i ! b s ! q s t f u c z : x f j h i y o h ! e f q f o e f o u p o l j - ! K b t l u f ! d p n q p o f o u ! b g f s
u f ! p s i p h o b r h s p o t w s n /

1322^ Jbu f t bn f n boof sbt jolu f t jyu f n cpejn f oupgGh/38-G V^Wjoejdbuf t lu f lpsu phpbobtsot gsn kdpf gdfj ou
pgu f lof x mqlsf qbsf e!crpdl IL/!Npsf pwf sly(-lz(joejdbuf t lu f lqpt jypolpgu f ljouf saphrjpo!qpjoulu f t bn f n boof sbt
jolu f t jtyu f n cpejn f ou

11323^ Tvctf rrvf ouz-lü f lwbjbcbrf/ljlt ldpvovf elvqjlo/T3216-lboeljljt l!vehf eljo/T3217!x i f ü f slpslopü f lcrpdl li psj.
{pobnrtndpn qpfv out lbf ldpn qrfvf e/ljZFT-lü f lqspdf t t joh!f wsof lp/T3214/ljOP-lü f lwbjbcbrf/ljlt ldpvovf elvqjlo/T3218/
ljlt l!vehf eljo/T3219!x i f ü f slpslopü f lcrpdl !wf sjdbnrtndpn qpfv out lbf ldpn qrfvf e/ljZFT-lü f lqspdf t t joh!f wsof lp
T3213/ljOP-ljlt l!vehf elü bubnrt75!dpn qpfv out lbf lqspdf t t f e-lü f sf czf/oejoh!ü f lqspdf t t joh/

1324^ Jb!ú f lt wf ou! f n cpejn f oule!jff sf ou!gn lu f lt jyú! f n cpejn f ou!pGh/138-lú f l!qpdf t t jh!jt! op!ut x judi f elcz
ú f lwbrwf! p!dj-!K!t!t f be-lú f! p!qf sb!ypo!p!gú f lt vn! p!dg!s!p!v!t! p!gú f! j!og!sn b!ypo!G! (N!K!p!gú f!)n , 2^ .ú! !gn! f! !be!ú f
j!og!sn b!ypo!G!N!K!p!gú f! !n .ú! !gn! f! !t! !qf !gn! f! elx ju! lu f! !x f! jhi! j!h!dpf! !j!f! ou!ef! qf! oef! ou!p!ú f! lwbrwf! p!dj-!K!t!t! qf! dij
j!b!n!x! !x! f! olú f! lwbrwf! t! p!gb!N!K! c!V!K!bsf! lt f! ubt! !gn!x! t-lú! !t! !dbt f! !dbolcf! !dpn! q!r!uf! !zf! f! v!jwbr!ou!p!ú f! !dbt f! !p!dGh/138/

$$b \vee k > 2 - c \vee k > 1) \text{ x i f o } j=5 \text{ boe } k=5^*$$

$b \sqrt{1-k} > 1 - c \sqrt{1-k} > 2$)pu f s x it f *)28*

\\1325^ .b!pü f slx pset -!ü f !f n cpejn f oupgGh/!38!jodmef t !ü f !f n cpejn f oupgGh/!47/!b!ü f !t f w f ou !f n cpejn f ou

pgGh/147-ljlt lqsf g sbcrh!up!t f ulü f lwbrwf !pgb!v!k!up!cf !rshf !jo!ü f !rpx .gf r vf odz!bsf b!boe!up!t f ulü f lwbrwf !pgc!v!k!up
cf !rshf !jo!ü f !i jhi .gf r vf odz!bsf b/
11326^ Npsf pwf s!ü f !gmpx joh!jt !hf of sbm!f t ubcrh! f e-lcvüü jt !jt !opuljm juf e/

6

b!v!k, c!v!k > 2

)29*

Tqf djÖbmn!x i f olü f !usbot gsn !dpf gÖj!f oupgü f !i jhi .gf r vf odz!bsf bljt !sf evdf e-lü f !gmpx joh!t f ujoht !t vÖj!f ouz
qpt t jcrf/

21

b!v!k, c!v!k = 2

)2: *

Jl!t lqsf g sbcrh!up!f yqf s!n f oubm!dbv!r!uf !ü f !dpf gÖj!f out f ujoht/

26

11327^ U! f !t zoü f t !jt !pgb!qmsbr!z!pg!n bhf t !cz!qsf qbsjö!ü f !psi phpobrtusbot gsn !dpf gÖj!f out !i bt !cf f olef t dšcf e
bcpwf /Tjodf !ü f !di bsbd!f s!t üdt !pgü f !t jyü !boe!t f wf ou !f n cpejn f ou !röf !jo!ü f !qspdf t t joh!pgebub!vt joh!ü f !psi ph.
pobrtusbot gsn -!ü f !dpot !v!wpot !ps!pqf sb!pot !pgü f !sqps!pot !t vdi !bt !ü f !n p!po!wf dups!pqf sb!po!vo!j!boe!ü f !t zo.
ü f t !j!joh!vo!j!bsf !opuljm juf e!!U! f !n p!po!wf dups!pqf sb!po!vo!j!ü bt !cf f olef t dšcf e!cbt f e!po!ü f !wf dups!dbv!r!u!j!po
vt joh!ü f !psi phpobrtusbot gsn !qspqf t e!cf gsf !cz!ü f !qsf t f oubqq!r!boulcvüü jt !jt !opuljm juf e!!Dpow! o!j!pobrtm f ü pet
t vdi !bt !b!n f ü pe!pgef t d!joh!b!qpt !j!po!j!o!x i jdi !ü f !t r vbsf !t vn !pgej!f sf od!t !pgaj!f r!h!po!ü f !sf brh qbdf !jt !n jojn vn
n bz!cf !vt f e/

31

11328^ Npsf pwf s!jo!ü f !ebub!qspdf t t joh!-!bt !t i px olcz!ü f !gmpx joh!f r vb!j!po!-!bt !n qrh!pqf sb!po!n bz!cf !qf sgsn f e
po!ü f !psi phpobrtusbot gsn !dpf gÖj!f out !pgü f !opuf e!crpd! !B!pgü f !n .ü !gbn f !boe!ü f !crpd! !C!i bwjoh!b!t n bnrt uf saps
pgü f !n , 2*.ü !gbn f /

36

 $G_L V^k > b V^k G_C(V^k, c V^k G_B V^k)$

)31*

11329^ Tqf djÖbmn!ü f !bcpwf .ef t dšcf e!f r vb!j!pot !pgü f !ebub!qspdf t t joh!dbo!hf of sbm!f t vnd!jo!ü f !gmpx joh/

41

$$F_k[i][j] = \sum_{q=1}^P \alpha_q[i][j] \cdot F_q[i][j] + \beta[i][j] \cdot F_A[i][j]$$

46

... (21)

51

1132: ^ .blü f !bcpwf !f r vb!j!po!-!r !ef opuf t !crpd! lovn cf sgsn f elpo!ü f !n , 2*.ü !gbn f -!q!ef opuf t !ü f !lovn cf spg!crpd! t
vt f eljo!ü f !ebub!qspdf t t joh!po!ü f !n , 2*.ü !gbn f -!boe b, !ef opuf t !b!dpf gÖj!f ou!jo!ü f !crpd! lovn cf sr /!blü f !f ybn qrh
pgGh/147-lt jodf !gvs!crpd! t !pgü f !n , 2*.ü !gbn f !bsf !vt f e-lq!>!5/

56

11331^ Tqf djÖbmn!jo!ü f !pqf sb!po!pgü f !t vn !pgqspvdu! pgü f !usbot gsn !dpf gÖj!f ouG₃V!k!jo!ü f !psi phpobrtusbot .
gsn !dpn qpof ouj!-!Kpgü f !opuf e!crpd! !B!pgü f !n .ü !gbn f -!boe!ü f !usbot gsn !dpf gÖj!f ouG₃V!k!jo!t pn f !crpd! t !G₃
of df t t bs!gs!ü f !ebub!qspdf t t joh!pgü f !n , 2*.ü !gbn f -!ü f !psi phpobrtusbot gsn !dpf gÖj!f ouG₃V!k!pgü f !of x !crpd!
L !jt !dbv!r!uf e/

61

11332^ Npsf pwf s!bt !t i px oljo!Ght /138-147-lx i f olü f lwbrwf !pgG₃V!k!ef qf oet !po!ü f lwbrwf !pgy(-!z!joejdb!wf !pgü f
ejt ubodf !pgü f !jouf s!pr!u!j!po!q!jou!ü f lwbrwf !dbo!cf !sf qsf t f ouf e!cz!ü f !gmpx joh/

66

$$F_k[i][j] = \sum_{q=1}^P h(x', y') \cdot \alpha_q[i][j] \cdot F_q[i][j] + \beta[i][j] \cdot F_A[i][j]$$

66

... (22)

\1333^ I f s f -i)y(-z"lef opuf t bofjouf sqprubjohlpqf sbjupolvgodjpolef qf oef oupolu f lejt ubodf lcf ux f f o l u f l j o u f sqprubjop
 qpjouboe!bo!pct f s b i j p o ! q p j o u ! Q p s l u f ! g r o d j p o - l j n f b s j o u f s q p r u b j o - l d v c j d ! d p o v m j p o ! j o u f s q p r u b j o - l b o e ! u f ! j n f ! d b o
 c f ! d p o t j e f s f e ! / U i f ! p s i p h p o b r u b o t g s n l d p f g d j f o u p g u f ! o f x l c r p d l ! d b o l c f ! q s f q b s f e l x j u ! j i ! g f f e p n ! e f h s f f ! g s n
 u f ! c r p d l ! j o g s n b j p o l p g b ! q m s b i j n e ! p g g s n f t ! v t j o h l u f ! f r v b j p o t !) 3 2 * ! b o e !) 3 3 * /
 6 \1334^ N p s f p w f s l j o l u f ! l t j y u ! b o e ! t f w f o u ! f n c p e j n f o u - l u f ! l e f t d s q j p o l i b t ! c f f o l c b t f e ! p o ! E D U ! p g u f ! c r p d l ! p g 9
 x ! 9 ! q j y f r h j o l u f ! p s i p h p o b r u b o t g s n - l c v l j u l h p f t l x j u p v u t b z j o h l u b u l f ! o v n c f s p g q j y f r h j t l o p u r n j u f e ! p ! u j t /
 \1335^ Q v s i f s n p s f - l j o l u f ! l t j y u ! b o e ! t f w f o u ! f n c p e j n f o u - l u f ! d p o j o v p v t ! j n b h f t ! p g u f ! n . u ! g s n f ! b o e ! u f ! j n , 2 * .
 u ! g s n f ! i b w f ! c f f o l e f t d s j c f e - l c v l d p o j o v p v t ! p s e j t d p o j o v p v t ! j n b h f t ! b s f ! o p u r n j u f e ! / U i f ! n p j p o ! w f d p s b o e ! u f
 p s i p h p o b r u b o t g s n l d p f g d j f o u c f u x f f o l u f ! n . u ! g s n f ! b o e ! u f ! j n , o * . u ! g s n f !) o p u ! 2 * ! d b o ! o b w s b r n ! c f ! t z o u f t j f e
 21 v t j o h l u f ! b c p w f ! l u d i o j r v f /
 \1336^ B t l e f t d s j c f e l b c p w f - l b d d p s e j o h ! p l u f ! l q s f t f o u j o w f o j p o - l x i f o l u f ! p s i p h p o b r u b o t g s n l d p f g d j f o u p g u f ! o f x
 c r p d l ! j t ! q s f q b s f e l c b t f e ! p o ! u f ! p s i p h p o b r u b o t g s n ! j o g s n b j p o l p g b ! q m s b i j n e ! p g g s n f t - l b o e ! u f ! j o w f s f ! p s i p h p o b m
 u b o t g s n ! j o g s n b j p o l j t ! q p t j j p o f e ! e f v j b j o h ! g s n ! u f ! t b n q r h ! q p j o u p g p s j h o b r j o g s n b j p o - l b ! q m s b i j n e ! p g j n b h f t ! d b o ! c f
 t z o u f t j f e l x j u p v l b o z ! e j t p s e f s /
 26 \1337^ B o l f j h i u ! f n c p e j n f o u p g u f ! l q s f t f o u j o w f o j p o b x j m f y u c f ! e f t d s j c f e ! / G h ! / 4 8 ! j t ! b ! c r p d l ! e j b h s n ! t i p x j o h l u f
 d p o t j u v j p o ! p g u f ! j n b h f ! q s p d f t t j o h ! b q q b s u r t ! b d d p s e j o h ! p l u f ! f j h i u ! f n c p e j n f o u p g u f ! l q s f t f o u j o w f o j p o - l u f ! d p o .
 t j u v j o h f r h n f o u t ! t j n j r s l u p l u p t f ! p g j h t ! / 2 5 ! b o e ! 3 6 ! b s f ! e f o p u f e l c z l u f ! t b n f ! s f g s f o d f ! o v n f s b r n - l b o e ! u f ! l e f t d s q j p o
 u f s f p g j t ! p n j u f e /
 \1338^ J b ! G h ! / 4 8 - l b t f r h d j p o l v o j u 2 4 3 ! w e h f t ! b l j n f ! j n b h f ! p l c f ! t f u b t ! b s f g s f o d f ! g s n f ! g s n ! j n b h f ! j o g s n b j p o ! p g
 31 j o , 2 * ! g s n f t ! t u p s f e ! j o l u f ! t u p s b h f ! v o j u 2 1 2 ! / J j t ! o p x ! b t t v n f e ! u b u l u f ! s f g s f o d f ! g s n f ! t f u b d d p s e j o h ! p l w e h n f o u
 s f t v r d j t ! u f o u b j u f r n l t f u p ! g s n f ! H ! / B ! g s n f ! d p o u s p r i v o j u 2 4 4 ! j t ! n f b o t ! p s t f r h d j o h ! u p l u z q f t ! p g j n b h f t ! b t ! q s p d f t t j o h
 p c k d u ! / Q p s l u f ! u x p ! u z q f t ! p g j n b h f t ! - p o f ! j t ! u f ! g s n f ! H ! b t ! u f ! s f g s f o d f ! g s n f ! - b o e ! u f ! p u f s j t ! p o f ! g s n f ! b n p o h
 t u p s f e l o ! g s n f t ! p u f s l u b o l u f ! g s n f ! H !) g s n f ! ! j t ! t f u /
 \1339^ U i f ! n p j p o ! w f d p s p q f s b j p o l v o j u 2 2 6 ! n f b t v s t ! n p w f n f o u b n p v o u p g q b s j b r n p w f n f o u b t ! u f ! n p j p o ! w f d p s
 36 c b t f e ! p o l u f ! l e j g f s f o d f ! p g u x p ! u z q f t ! p g j n b h f t ! p g u f ! g s n f t ! H ! b o e ! ! / U i f ! d p o t j u v j p o ! p g u f ! n p j p o ! w f d p s p q f s b j p o
 v o j u 2 2 6 ! j u f r d j t ! u f ! t b n f ! b t ! u - b u p g u f ! g v s i ! p l t f w f o u ! f n c p e j n f o u /
 \133: ^ B l e b u ! q s p d f t t j o h ! v o j u 2 4 7 ! v t f t ! u f ! j n b h f t ! p g g s n f t ! ! b o e ! H ! p l d b r n r n u f ! u f ! j n b h f ! Q ! p s l u f ! j n b h f ! j o g s
 n b j p o ! p g u f ! g s n f ! H - l b o e ! t v q q j t ! u f ! j n b h f ! p l u f ! f l v c t f r v f o u t u b h f ! b s b o h n f o u q s p d f t t j o h ! v o j u C ! / U i f ! p q f s b j p o
 p g u f ! t z o u f t j f j o h ! v o j u 2 1 7 ! b o e ! u f ! t v c t f r v f o u p q f s b j p o l b s f ! t j n j r s l u p l u p t f ! p g u f ! g v s i ! p l t f w f o u ! f n c p e j n f o u /
 41 \1341^ G h ! / 4 9 ! j t ! b ! c r p d l ! e j b h s n ! t i p x j o h ! p o f ! f y b n q r h ! p g u f ! l d p o d s f ! d p o t j u v j p o ! p g u f ! t f r h d j p o l v o j u 2 4 3 ! b t ! p o f
 d i b s b d f s t j d ! p g u f ! f j h i u ! f n c p e j n f o u ! ! f s f - l b t ! u f ! f y b n q r h - l j u j t ! b t v n f e ! u b u g v s g s n f t ! j o l u p b r n p d p o j o v p v t
 j n b h f t ! g s n l u f ! n . u ! g s n f ! p l u f ! n , 4 * . u ! g s n f ! b s f ! t u p s f e ! j o l u f ! t u p s b h f ! v o j u 2 1 2 ! / O v n f s b r n ! 3 1 2 - 3 1 3 - 3 1 4 - 3 1 5 ! e f o p u f
 f e h f ! f y u b d j p o l v o j u - l x i j d i ! b s f ! n f b o t ! g s f y u b d j o h ! f e h f ! j o g s n b j p o ! j o d n e f e ! j o ! u f ! j n b h f ! c b t f e ! p o ! u f ! j n b h f
 j o g s n b j p o ! p g u f ! t u p s f e ! g v s g s n f t /
 46 \1342^ G h ! / 4 : ! t i p x t ! u f ! f y b n q r h ! p g b ! h f o f s b r n b q r d j b o ! f e h f ! f y u b d j p o ! Q r d s /
 \1343^ O p x - l b t t v n j o h l u b u l f ! l q j y f r h b w f ! j o ! d p p s e j o b u f !) y - l z " ! p o l u f ! j n b h f ! p g j n , t * . u ! g s n f !) 1 - l t - l 4 * ! j t ! t f u p ! g
) y - l z " - b o e ! u f ! b w r f ! b g f s l u f ! f e h f ! f y u b d j p o l q s p d f t t j o h ! j t ! t f u p ! !) y - l z " - l u f ! g o m p x j o h ! p q f s b j p o ! p g u f ! t v n ! p g q s p e v d u
 j t ! q f s g s n f e ! j o ! u f ! f e h f ! f y u b d j p o ! Q r d s p g G h ! / 4 : /

$$I_1(y, z^* > q) y, 2-z, 2^*, q) y, 2-z, q) y, 2-z.$$

$$2^*, q) y, 2-z, 2^*, 9q) y, z^*, q) y, 2-z^*, q) y, 2-z, 2^*, q) y,$$

$$z, 2^*, q) y, 2-z, 2^*$$

$$) 3 4 ^ *$$

\1344^ J b ! G h ! / 4 9 - l f e h f ! t u f o h u ! f w b r m b j p o l v o j u ! 3 1 6 - 3 1 7 - 3 1 8 - 3 1 9 ! b s f ! n f b o t ! g s j o u f h s b j o h ! f e h f ! t u f o h u ! t ! f y .
 u b d f e l c z l u f ! f e h f ! f y u b d j p o l v o j u ! 3 1 2 ! p ! 3 1 5 ! p w f s l u f ! f o u s f ! j n b h f ! / X i f o l u f ! o v n c f s p g w f s j d b r n j y f r h j t ! p g u f ! f o u s f
 j n b h f ! j t ! t f u p ! W ! b o e ! u f ! b o v n c f s p g i p s j ! p o u b r n j y f r h j t ! t f u p ! ! - l u f ! f e h f ! t u f o h u ! Q x ! p g u f ! j n , t * . u ! g s n f ! j t ! d b r n r n u f e
 61 b t ! g o m p x t ;

$$P_s = \sum_{x=0}^H \sum_{y=0}^V k_s^1(x, y) \quad \dots \quad (24)$$

j o l x i j d i

! ()y-lz"!>!) ()y-lz"!>!)x i f o!) ()y-lz"!>!)u!)u! lef opuf t!blqsf t f du! s t i pralwbrmf ~!boe
! ()y-lz"!>!)!jolu f ldbt f t!pu f slu bolu f lbcpwf /

1345^ B!n byjn vn !f ehf !t uf ohu! lef u sn jobupo!voju31: lef u sn jof t!blqbn f !t !jox i jdi !Q! pcubjof elczlf bdi !pgu f
f ehf !t uf ohu! f wbrmbupo!voju!316!up!319!jt !n byjn vn !bt !u f !sf g s f od f !gbn f !/Tqf dj!dbn!u f !f ehf !t uf ohu! !x i jdi
6 jt !blvojr vf !f wbrmbupo!grodypo!jt !t f u!boe!u f !gbn f !jox i jdi !u f !f ehf !t uf ohu! !jt !f wbrmbuf elbt !cf joh!rshf t upw! slu f
f ouf! ljn bhf !jt !t f rhdv elbn poh!u f !t upf elqmsbrjz!pgggn f t !pgjn bhf t /
1346^ Up!t f u! f !jn bhf !x ju !u f !rshf t d f ehf !t uf ohu! !bt !u f !sf g s f od f !gbn f !jt !bewboubhf pvt !op!pom!x i f o!u f
n pu!pof dups!t !dbdvrbf ebt !ef t dscf ehtuf stcvbrtpx i f o!u f !ebub!qpdf t t joh!pgu f !pu f !pcK dugbn f t !jt !qf sgn f e/
!blu f !f wbrmbupo!czlu f !f ehf !t uf ohu! !-!bol!n bhf !x i pt f !gdvt !jt !n pt !drfbszl!qdl f e.vq!dbo!cf !bt t vn f elbn poh!u f
21 t upf elqmsbrjz!pgggn f t !/U! f !sf g s f -!u f !jn bhf t !pgu f !pcK dugbn f t !pu f slu bolu f !sf g s f od f !gbn f !t f sw! !p!bubdi
bol!bee!jupobr!wbrmf !pu! f !jn bhf !r vbrjz!pgu f !sf g s f od f !gbn f !-!boe!u f !f oi bodf n f oupgu f !jn bhf !r vbrjz!f r vbrtp!ps
hsf bu! slu bolu bu!pgu f !sf g s f od f !gbn f !t joh!z!dbo!cf !f ot vsf el!f w o!b!n join vn /
1347^ Npsf pwf s!gslu f !dpot yw!po!pg G!h!49!-!p!gdjrbu! !u f !ef t d!q!po!-!u f !f ybn qrn!jox i jdi !bmr!gn f t !bsf
qpdf t t f eljo!bl!sx !i bt !cf f o!ef t dscf e-lcvdu f !dpot yw!po!n bz!lobwbrn!dpn qst f !bt joh!r!f ehf !f yusb!po!voju!boe
26 f ehf !t uf ohu! f wbrmbupo!vojugsb!w! s!dbtr!qpdf t t joh!
1348^ Npsf pwf s!jolu f !f r vb!po!)35!u f !bct prmf !wbrmf !pg! ()y-lz"!>!)t !vt f !egslu f !dbdvrb!po!pg! ()y-lz"!>!)cvlu f
t r vbsf !pg! ()y-lz"!>!)n bz!lobwbrn!cf !vt f el!qf sgn !u f !pqf sb!po/
1349^ U! f !ebub!qpdf t t joh!voju247!x jmf yulcf !ef t dscf elx ju !sf g s f od f !p!G!h!51/
134: ^ !b!G!h!51!-!bdppsejobu! !n bobhf n f ouvoju86: !n bobhf t !u f !qpt j!po!pgu f !gbn f !H!bt !u f !sf g s f od f !gbn f
31 up!x i jdi !u f !crpdl !pgu f !gbn f ! !bt !u f !pcK dugbn f !jt !p!dpsf t qpoe!jo!bdpsebodf !x ju !u f !w! dups!dbdvrbf e!gn
u f !n pu!pof dups!pqf sb!po!voju226!U! f !dppsejobu! !n bobhf n f ouvoju86: !pvu!v! !bolbeesf t t !jox i jdi !u f !f wbrmbupo
grodypo!pgu f !f r vb!po!)8!jt !n join vn /
1351^ Bo!O x!O!crpdl !gn joh!voju869!gn t !u f !jn bhf !pgu f !gbn f ! !joup!b!crpdl !jolu f !voju!pgO x!O!qjyf r!v!U! jt
n f bot !epf t !op!of f el!p!cf !qf sgn f el!jolu f !ebub!qpdf t t joh!voju247!-!jgu f !qjyf r!wbrmf !jogn b!po!pgu f !crpdl !sf g s f e
36 up!bt !u f !opuf el!crpdl !vt f el!jolu f !qsf w!pvt .t ubhf !n pu!pof dups!pqf sb!po!voju226!jt !sf ubjof e/
1352^ Tjn jrbz!bo!O x!O!crpdl !gn joh!voju864!gn t !u f !crpdl !pgu f !O x!O!qjyf r!voju!pgu f !gbn f !H!c!bt f el!po
u f !beesf t t !sf d jw!f !gn !u f !dppsejobu! !n bobhf n f ouvoju86: !/U! jt !n f bot !epf t !op!of f el!p!cf !qf sgn f el!jolu f
ebub!qpdf t t joh!voju247!-!jgu f !qjyf r!wbrmf !jogn b!po!pgu f !crpdl !sf g s f e!up!bt !u f !f sgn join vn !crpdl !x i pt f
f wbrmbupo!grodypo!jt !n join vn !boe!u f !crpdl !qpt j!pof el!jolu f !qf sqi f sz!pgu f !f sgn join vn !crpdl !sf g s f e!up!bt
41 u f !qf sqi f sbr!crpdl !bsf !sf ubjof elbn poh!u f !crpdl t !qsf qbsf e!boe!f wbrmbuf eljot jef !u f !qsf w!pvt .t ubhf !n pu!pof dups
pqf sb!po!voju226/
1353^ Opx!-!u f !opuf el!crpdl !polu f !gbn f ! !jt !t f up!u f !crpdl !B!-!boe!u f !f sgn join vn !crpdl !x ju !sf t qf d!up!u f
crpdl !B!polu f !gbn f !H!jt !t f up!u f !crpdl !C!n psf pwf s!bn poh!x !uzqf t !pgcrpdl t !gn f elcz! ps! (poubr! i jg!oh!f bdi
cz!pof !qjyf r!p!u f !r!hg!boe!u f !shi uvt joh!u f !crpdl !C!bt !u f !sf g s f od f -!u f !crpdl !x i pt f !f wbrmbupo!grodypo!jt !f wbrmbuf e
46 bt !cf joh!t n br!jt !t f up!u f !crpdl !D!T!n jrbz!bn poh!x !uzqf t !pgcrpdl t !gn f elcz! i jg!oh!f bdi !cz!pof !qjyf r!vqx bse
boe!epx ox bse!jolu f !w! s!dbtr!esf d!po!vt joh!u f !crpdl !C!bt !u f !sf g s f od f -!u f !crpdl !x i pt f !f wbrmbupo!grodypo!jt
f wbrmbuf elbt !cf joh!t n br!jt !t f up!u f !crpdl !E/
1354^ Npsf pwf s!u f !crpdl !x i jdi !i bt !y!dppsejobu! !pgps!ho!pgu f !crpdl !D!boe!z!dppsejobu! !pgps!ho!pgu f !crpdl !E
jt !t f up!u f !crpdl !F!U! f !crpdl !F!ef w!b!t !gn !u f !crpdl !C!cz!pof !qjyf r!p!f bdi !pgu f !i ps! (poubr!boe!w! s!dbtr!esf d!pot /
51 1355^ Bo!bwf sbhf !wbrmf !dbdvrb!po!voju865!jt !n f bot !gs!t f qbs!joh!u f !bwf sbhf !wbrmf !pg!qjyf r!wbrmf t !x ju !jolu f
crpdl !B!bt !u f !opuf el!crpdl !/X i f o!u f !ps!ho!dppsejobu! !pgu f !crpdl !B!jt !t f up!)b1-lc1!-!u f !bwf sbhf !wbrmf !U!pgu f
crpdl !B!jt !dbdvrbf elbt !gnpx t /

$$T_A = 1/N^2 \times \sum_{x=a_0}^{a_0+N-1} \sum_{y=b_0}^{b_0+N-1} f_H(x, y) \quad \dots (25)$$

51)jox i jdi !g)y-lz"!>!)ef opuf t !u f !qjyf r!wbrmf !pgdppsejobu!)y-lz"!>!)pgu f !gbn f ! !
1356^ Bo!bwf sbhf !wbrmf !t f qbs!po!voju866!jt !n f bot !gs!t f qbs!joh!u f !dbdvrbf el!bwf sbhf !wbrmf !U!gn !f bdi
qjyf r!jolu f !crpdl !B!cz!t vcs!d!po!/X i f o!u f !wbrmf !bgf slu f !t vcs!d!po!jt !t f up!h)y-lz"!>!)dbdvrb!po!jt !qf sgn f eljo
u f !gnpx joh!f r vb!po!)37^/

$$h_1 \text{)y- } z^* > q \text{)y- } z^* . U_B \quad \text{)37}^*$$

qpjoult !ü f !pšjho!pgü f !crpdl !B-lboelj! !bo!bssboh f n f ou!pgjou/
 \1363^ Ü! f !f r vbüpo!)42*!n f bot !ü bulü f !bwf sbhf !wbrmf !pgü f !crpdl !Bljt !t vct üwuf e!gslü f !bwf sbhf !wbrmf t !pgü f
 crpdl t !C(-!D-!E-!F!Beejüpbom!ü f !bwf sbhf !wbrmf !p!cf !t vct üwuf e!jt !ef qf oef oupolü f !jouf šqrbüjpo!qpjoupgü f !crpdl
 B-lboelü f !jouf bslpqf sbüjpo!pgü f !bwf sbhf !wbrmf t !pgdov!crpdl t !jt !qf špsn f e! !ü!pü f !sx pšet -!ü f !ED!dpn qpof oupgü f
 6 crpdl !Bljt !di boh f e!t p!bt !p!cf !Ü!gslü f !crpdl t !C(-!D-!E-!F!po!ü f !šf šf odf !gšn f -!t p!ü b!pözlü f !BD!dpn qpof oupg
 ü f !crpdl !Bljt !vüj!f e/
 \1364^ Ü! f !ebub!qspdf t t joh!vojü247!i bt !cf f olef t dšcf e!bcpw! -!cvüü f !f jhi ü !f n cpejn f ou!jt !opüj!m jüf e!p!ü f
 bcpw! .ef t dšcf e!f ybn qrfv!Tjodf !ü f !crpdl t !C(-!D-!E-!F!r!bshf !p!pwf šbq!pof !bopü f !šü f !šf !n bz!cf !op!r!bshf !ej!šf odf
 bn poh!ü f !db!r!v!r!uf e!bwf sbhf !wbrmf t ! !ü!ü jt !dbt f -!bt !jn qrf!n f ü pe!n bz!cf !vt f e!x i jdi !dpn qšt f t !beejoh!pözlü f
 21 bwf sbhf !wbrmf !Ü!(!pgü f !crpdl !C(!p!hl)y-lz'/
 \1365^ Qh/!53!t i pxt !ü f !C!x di bslpgü f !pqf sbüjpo!qspdf evš !pgšf qf b!f e!qspdf t t joh!jod!r!v!ejoh!ü f !qspdf t t joh!šps
 db!r!v!r!ujoh!boe!bssboh!joh!ü f !n p!jö!w!f d!ps!df ouf šjoh!po!ü f !gšn f !dpouš!r!v!ejoh!244!qbs!j!v!r!b!z!x i f olü šf f !ps!n pš
 gšn f t !bsf !vt f e/
 \1366^ Qšt !joh!T: 12-!ü f !f ehf !t uf ohü !jt !f !wbrmf e!gslf bdi !pg!)o, 2*!gšn f t !gšn !ü f !n .ü !gšn f !p!ü f !!)n , o*.ü
 26 gšn f !T!vct f r v f ouz!-!joh!T: 13-!ü f !gšn f t !bsf !dpn qbsf e!x jü !f bdi !pü f šf
 \1367^ Tvct f r v f ouz!-!joh!T: 14-!ü f !!)n , q*.ü !gšn f !i b!vjoh!ü f !n by!n v!n !f ehf !t uf ohü !jt !t f !dbt !ü f !gšn f !H-lx i jdi
 jt !ü f !šf šf odf !gšn f !/Of y!joh!T: 15-lwšj!b!r!ht !t !boe!r !bsf !joh!j!b!r!f e!p!q!spw!ef !1! !j!t !ü f !o!k!v!ehf e!joh!T: 16!x i f ü f s
 pš!opulü f !wšj!b!r!ht !jt !f r v!b!r!p!q! !Ü! jt !ef üf sn jof t !x i f ü f !šps!opulü f !gšn f !p!cf !qšf t f ouz!qspdf t t f e!jt !ü f !šf šf odf
 gšn f /
 31 \1368^ !jü f !gšn f !t !p!cf !opx !qspdf t t f e!jt !opulü f !šf šf odf !gšn f -!j!jt !k!v!ehf e!joh!T: 17!x i f ü f !šps!opulü !f r v!b!r!
 {f sp! !Ü! jt !ef üf sn jof t !x i f ü f !šps!opulü f !šf qf b!joh!šf r v f odz!pgü f !qšf t f ou!qspdf t t joh!jt !Ö! !j!n f ! !j!r !f r v!b!r!{f sp-
 ü f !gšn f !H!jt !bssboh f e!joh!T: 18-lboelü f !wšj!b!r!ht !jt !dpv!uf e!v!q!joh!T: 19! !ü! f !of h!b!j!w!f !ef üf sn j!ö!j!p!pgT: 17-lj!jt
 ef üf sn jof elü bulü f !qspdf t t joh!jt !šf qf b!f e!x j!f !ps!n pš -!boelü f !gšn f !H!bt !ü f !šf šf odf !gšn f !jt !bsf bez!bssboh f e-
 t p!ü b!T: 18-!T: 19!bsf !w!n qf e/
 36 \1369^ Tvct f r v f ouz!-!joh!T: 1- !ü f !n p!jö!w!f d!ps!jt !db!r!v!r!uf e!cf !x f f olü f !gšn f !H!boe!ü f !!)n , t *.ü !gšn f !!)gšn f
 ! */!Of y! !bgf slü f !ebub!qspdf t t joh!pgü f !gšn f ! ! !joh!T: 21-lü f !bssboh f n f ou!pgü f !gšn f ! ! !jt !qf špsn f e!joh!T: 22! !bgf s
 dpv!joh!v!q!ü f !wšj!b!r!ht !joh!T: 23-lj!jt !k!v!ehf e!joh!T: 24!x i f ü f !šps!opulü f !šf qf b!joh!šf r v f odz!šf bdi f t !o. !j!n f t ! !j!opu-
 j!jt !k!v!ehf elü bulopo. qspdf t t f e!gšn f !jt !t !pšf e-lü f !qspdf t t joh!šf wšot !p!T: 16-lboelü f !t !jn j!r!b!qspdf t t joh!jt !šf qf b!f e
 polü f !pü f !šgšn f t /
 41 \136: ^ X i f olü f !bssboh f n f ou!pg!b!r!ü f !t !pšf e!gšn f t !jt !dpn qrf!uf e!-!pof !gšn f !p!j!n b!hf !j!ogšn b!jö!jt !t z!ou f t !j!f e-
 ü f !šf cz!f oejoh!ü f !qspdf t t joh/
 \1371^ B!t f šjt !pg!qspdf t t joh!pgü f !f jhi ü !f n cpejn f ou! bwf !cf f olef t dšcf e-lboe!ü f !n pt !üdi bš!d!f šjt !j!d!qbs!p!g
 ü f !f jhi ü !f n cpejn f ou!šjt !joh!ü f !t f r!nd!j!p!v!ojü243! !Ü! f !šf šf -!ü f !dpot!f ou! !pgü f !n p!jö!w!f d!ps!pqf sbüjpo!vojü226-
 ü f !ebub!qspdf t t joh!vojü247-lü f !bssboh f n f ou!qspdf t t joh!vojü216-lboe!ü f ! !j!f !bsf !opüj!m jüf e! !Ü! f !n p!jö!w!f d!ps
 46 pqf sbüjpo!dbolcf !šf b!r!f e!f w! oljoh!ü f !n f ü pe!op!v!t joh!ü f !ps! ph!pöb!r!b!ot gšn -!boe!ü f !dpot !j!v!j!p!n bz!dpn qšt f
 pözl!bssboh!joh!ü f !q!j!f r!wbrmf !pgf bdi !p!cf d!gšn f !x jü p!v!qspdf t t joh!boz!ebub!pgü f !p!cf d!gšn f /
 \1372^ Nps! p!w! slü f !f wbrmf!jö!p!g!r!od!j!p!pgü f !f ehf !t uf ohü !pgü f !f r vbüpo!)35*!jt !opüj!m jüf e! !Ü! f !p!m!x j!oh!f r vbüpo
)43*!dbol!b!r!p!cf !dpot !j!f e!f e!bt !ü f !n pe!j!ö!b!jö!p!pgü f !f r vbüpo!)8*;

$$P_s = \sum_{x=0}^H \sum_{y=0}^V k_s^i(x, y) \quad \dots \quad (32)$$

joh!x i jdi
 ! ()y-lz"!>!2-lx i f ol! ()y-lz"*) p!ü !ü !ef op!t f !b!qšf t f !ü šf t i p!r!wbrmf *-!boe
 ! ()y-lz"!>!1!joh!ü f !dbt f t !pü f !šü bolü f !bcpw! /
 \1373^ Ü! jt !n f bot !ü bulü f !ov!n cf !špg!q!j!f r!ht !jt !dpv!uf e!x i f olü f !wbrmf !bgf slü f !f ehf !f yusb!jö! !Ö! šf bdi f t !b
 61 df sb!jö!ü šf t i p!r!wbrmf !ps!n pš !/Fw! oljoh!ü f !f r vbüpo!)43*!ü f !f ehf !t uf ohü !pgü f !f oušf !jn b!hf !dbol!t v!g!j!f ouz!cf
 hšbt qf e/
 \1374^ Nps! p!w! slü f !dpf !j!j!f oupgü f !f ehf !f yusb!jö! !Ö! šjt !opüj!m jüf e!p!ü f !dpf !j!j!f ou!t i p!x oljoh!Qh/!4: -!boelü f
 Ö! š!i b!joh!b!t !špohf š!opjt f !šf t !t !w!odf !n bz!cf !vt f e/
 \1375^ Q!v!ü f !n pš -!gslü f !f wbrmf!jö!p!pgü f !f ehf !t uf ohü -!t !zt !f n t !joh!x i jdi !op!f ehf !f yusb!jö! !Ö! šjt !vt f e!t vdi
 66 bt !b!t !zt !f n !pg!qf špsn j!oh!ef !f sn j!ö!j!p!c!b!t f e!po!ü f !š!b!ot gšn !dpf !j!j!f oupgü f !i jhi .šf r v f odz!dpn qpof oupgü f
 ps! ph!pöb!r!b!ot gšn !n bz!b!r!p!cf !dpot !j!f e!f e! !ü!ü jt !dbt f -!ü f !gšn f !joh!x i jdi !ü f !i jhi .šf r v f odz!q!x f !šjt !r!bshf !jt
 f wbrmf e-lboe!ü f !gšn f !x i pt f !q!x f !šjt !f wbrmf e!bt !cf j!oh!r!bshf !jt !t f !dbt !ü f !šf šf odf !gšn f /
 \1376^ Beejüpbom!-!joh!ü f !f jhi ü !f n cpejn f ou!ü f !f ehf !j!ogšn b!jö!jt !vt f e!joh!ü f !jn b!hf !di bš!d!f šjt !j!d!bn pv!ou!cvu

- ú jt ljt lopuljm juf e-lboe!ú f lpu f sljn bhf ldi bsdúf stj yd!bn pvou!n bz!cf lvt f elup!qf sgsn lú f lf wmbujpo/
 \1377^ G!h/!54!jt l!b!Q!x di bsut i px joh!ú f l!pqf sbujpo!qspdf evs l!b!ddpsejoh!up!blojou lf n cpejn f ou!pgú f l!qsf t f ou!jowf o.
 ýpo!l!b!ú f l!ojou lf n cpejn f ou!pom!ú f l!t f r!hdjoh!n f u! pelcz!ú f l!t f r!hdjop!voju243!pg!G!h/!48!jt lej!gf s!f ou!boe!ú f l!pu f s
 voj!t l!bs! lú f l!t bn f /
- 6 \1378^ N!ps!pwf sl!jo!ú f l!Q!x di bs!pg!G!h/!54!ú f s!f l!t l!t i px o!bo!f ybn qrh!jo!x i jdi l!pof l!g!bn f l!pgi jhi .s!f t p!m!jpo!lt ýjm
 jn bhf l!t l!qsf qbs!f el!cbt f el!po!ú f l!jn bhf l!jogsn býpo!pg!o, 2*!g!bn f t l!g!pn lú f l!n .ú l!g!bn f l!p!ú f l!n , o*.ú l!g!bn f /
 \1379^ J!b!le!j!wt j!po!qspdf t t l!pg!T2112-lú f l!jof hf slqps!jpo!pgú f l!ej!wt j!po!pg!w!w!f l!olcz!3!jt l!t vct ý!w!f el!bt l!q!l!ú f l!b!d!w!bm
 qspdf t t j!h!d!bo!cf l!s!f b!r!j!f el!cz!cj!t i j!g!oh!l!T!vct f r!vf ouz!l!jo!T2113-lú f l!n , q*.ú l!g!bn f l!t l!t f ubt lú f l!g!bn f l!H!x i jdi l!t
 ú f l!s!f g!s!f odf l!g!bn f l!O!f y!j!o!T2114-l!w!s!j!b!c!r!t l!t l!boe!r l!bs!f l!j!o!j!b!r!j!f el!up!qsp!w!ef l!1!l!jt lú f o!l!w!ehf el!jo!T2115!x i f u! f s
 ps!opulú f l!w!s!j!b!c!r!t l!t l!f r!v!b!r!p!q!l!ú j!t l!ef úf sn jof t!x i f u! f s!ps!opulú f l!g!bn f l!p!cf l!qsf t f ouz!qspdf t t f el!jt lú f l!s!f g!s!f odf
 g!bn f /
- 21 \137: ^ J!ú f l!g!bn f l!T!p!cf l!opx!qspdf t t f el!jt lopulú f l!s!f g!s!f odf l!g!bn f l!l!jt l!w!ehf el!jo!T2116!x i f u! f s!ps!opulú l!t l!f sp/
 U!t l!ef úf sn jof t!x i f u! f s!ps!opulú f l!g!f r!vf odz!pgú f l!qsf t f ouz!qspdf t t j!h!jt l!Q!t l!jn f l!l!jt l!t f sp-lú f l!g!bn f l!H!jt l!b!s!boh!f e
 jo!T2117-l!boe!ú f l!w!s!j!b!c!r!t l!t l!dp!v!of el!v!j!o!T2118!l!b!ú f l!of h!b!j!w!f l!ef úf sn j!o!j!po!pg!T2116-l!j!jt l!ef úf sn jof el!ú bulú f
 qspdf t t j!h!jt l!s!f qf búf el!ux j!d!f l!ps!n ps!f -l!boe!ú f l!g!bn f l!H!bt lú f l!s!f g!s!f odf l!g!bn f l!t l!b!r!f bez!l!b!s!boh!f e-l!t p!ú bu!T2117-
 T2118!l!bs!f l!wn qf e/
- 26 \1381^ T!vct f r!vf ouz!l!jo!T2119-lú f l!n p!j!po!w!f d!ps!jt l!b!r!v!r!v!f el!cf ux f f o!ú f l!g!bn f l!H!boe!ú f l!n , t*.ú l!g!bn f l!g!bn f
 l! *!l!B!g!f slú f l!eb!b!qspdf t t j!h!pgú f l!g!bn f l!l! j!o!T211: -lú f l!b!s!boh!f n f ou!pgú f l!g!bn f l!l! j!t l!qf sgsn f el!jo!T2121!l!B!g!f s
 dp!v!oj!h!v!q!ú f l!w!s!j!b!c!r!t l!j!o!T2122-l!j!jt l!w!ehf el!x i f u! f s!ps!opulú f l!s!f qf bý!h!l!g!f r!vf odz!s!f b!d!f t!l!o!ýn f t!X i f o!lo!po.
 qspdf t t f el!g!bn f l!t l!ps!f e-lú f l!qspdf t t j!h!s!f ús!ot l!p!T2115-l!boe!ú f l!jn j!r!bs!qspdf t t j!h!jt l!s!f qf búf el!po!ú f l!p!ú f s!g!bn f t /
- 31 \1382^ X i f o!ú f l!b!s!boh!f n f ou!pg!b!r!t f l!t ps!f el!g!bn f t l!t l!dpn qrh!f e-l!b!t j!oh!r!l!jn bhf l!t l!zou f t!j!f e-lú f s!f cz!f oe!joh
 ú f l!qspdf t t j!h/
- \1383^ B!t l!ef t!d!j!cf el!b!cp!w!f -lú f l!ojou lf n cpejn f ou!jt l!di bsdúf stj f el!jo!ú bulú f l!t f r!hdjop!pgú f l!s!f g!s!f odf l!g!bn f l!t
 ef úf sn jof el!b!ddpsejoh!up!ú f l!j!o!qv!f el!g!bn f l!ps!f s/
- 36 \1384^ G!h/!55!t i px t!ú f l!ef úf sn j!o!j!po!pgú f l!s!f g!s!f odf l!g!bn f l!x i f o!ú!w!f l!g!bn f t l!bs!f l!t ps!f e!l!ú f l!g!bn f l!t i px o!cz
 t!r!o!j!h!r!j!f t!jt lú f l!s!f g!s!f odf l!g!bn f /
- \1385^ X i f o!ú!w!f l!g!bn f t!pg!jn bhf t!bs!f l!t ps!f e-l!o!>!5-lú f o!ú f l!ej!wt j!po!cz!3!s!f t vr!t!j!o!q!>!3-l!t p!ú bulú f l!n , 3*.ú
 j!of sn f el!b!f l!g!bn f l!t l!t f ubt lú f l!s!f g!s!f odf l!g!bn f l!l!ú f l!s!f g!s!f odf l!g!bn f l!t l!dpn qbs!f el!x!ú lú f l!p!ú f s!g!v!s!g!bn f t l!p!q!f sgsn
 ú f l!qspdf t t j!h/
- 41 \1386^ J!ú f l!ovn cf sl!pgt ps!f el!g!bn f t l!t l!bo!f w!f o!ovn cf slú f l!ej!wt j!po!pg!o!cz!3!s!f t vr!t!j!o!b!lo!po.j!of hf s!l!ú f l!s!f g!s!f -
 ú f l!g!bn f l!d!boop!uf y!b!duz!cf l!j!of sn f el!b!f -l!cv!ú f l!g!bn f l!cf g!s!f l!boe!l!b!g!f slú f l!n j!eer!h!n bz!cf l!t f ubt lú f l!s!f g!s!f odf l!g!bn f
 j!o!ú f l!Q!x di bs!pg!G!h/!54-lú f l!g!bn f l!t l!cf g!s!f lú f l!n j!eer!h!n!T!q!f d!j!Q!b!r!m!l!jo!ú f l!n f u! pe!l!b!ddpsejoh!up!ú f l!f n cpejn f ou
 pgú f l!Q!x di bs!pg!G!h/!53-lú f l!t f r!hdjop!pgú f l!s!f g!s!f odf l!g!bn f l!t l!t f ubt f el!po!ú f l!jn bhf l!di bsdúf stj ý!d!l!ú f l!f ehf
 t!uf oh!ú j!t l!f w!b!mb!f el!bt lú f l!f w!b!mb!j!po!g!od!j!po!x i jdi l!d!bo!s!f qsf t f ou!ú f l!di bsdúf stj ý!d!bn pv!ou!pgú f l!jn bhf l!n pt u
 s!f n bs!b!cz!l!j!t l!d!f sb!j!o!t!ú b!x i f o!t f r!hdjop!jt l!qf sgsn f el!cz!ú f l!jn bhf l!di bsdúf stj ý!d!lú f l!jn bhf l!b!w!j!h!bo!p!q!ýn vn
 jn bhf l!r!v!b!r!j!z!l!d!bo!cf l!t f ubt lú f l!s!f g!s!f odf l!g!bn f /
- 46 \1387^ l!px f w!s!t j!odf lú f l!dp!oj!vp!vt l!jn bhf t!bs!f l!boe!r!ne-lú f l!jn bhf l!d!boop!uf df t t b!j!m!cf l!t b!j!e!up!cf l!p!q!ýn vn l!j!o
 p!j!ou!pg!ýn f l!ú f l!s!f g!s!f -l!jo!ú f l!f n cpejn f ou!pgú f l!Q!x di bs!pg!G!h/!54-l!t f r!hdjop!jt l!qf sgsn f el!cz!n b!j!oh!n v!d! l!pg!ú f
 ýn f l!dp!ss!f r!u!j!po!pgú f l!jn bhf t!#!X i f o!ú f l!j!of sn f el!b!f l!jn bhf l!jo!ú f l!ýn f l!b!j!t l!t l!v!t f e-l!boe!l!dpn qbs!f el!x!ú lú f l!g!bn f t
 pgú f l!t ps!f el!jn bhf t-l!boe!ú f l!jn bhf l!dp!oj!v!j!z!jt l!dpot j!ef s!f e-lú f l!d!f ou!b!r!jn bhf l!b!w!j!h!ú f l!j!h!f t l!jn bhf l!dp!ss!f r!u!j!po
 d!bo!cf l!f t ýn búf el!T!q!f d!j!Q!b!r!m!l!t j!odf lú f l!ýn f l!ef w!b!j!po!jt l!n j!o!jn vn -lú f l!lej!gf s!f odf l!cf ux f f o!f b!d! l!g!bn f l!boe!ú f l!s!f g!s!
 f odf l!jn bhf l!d!bo!cf l!n j!o!jn j!f e/
- 51 \1388^ U!f l!f n cpejn f ou!pgú f l!qsf t f ou!jowf o!j!po!l!b!w!f l!cf f o!lef t!d!j!cf el!b!cp!w!f -l!cv!b!dpn qspn j!t f l!cf ux f f o!ú f l!Q!x .
 di bs!t l!pg!G!h/!53!boe!l!54!d!bo!b!r!p!cf l!dpot j!ef s!f e!l!T!q!f d!j!Q!b!r!m!l!ú f l!di bsdúf stj ý!d!bn pv!ou!pgú f l!jn bhf l!boe!ú f l!qpt j!j!po
 po!ú f l!ýn f l!b!j!t l!bs!f l!dpot j!ef s!f el!up!qsf qbs!f l!bo!f x l!f w!b!mb!j!po!g!od!j!po-l!t p!ú bulú f l!s!f g!s!f odf l!g!bn f l!d!bo!cf l!ef úf sn jof e/
 J!b!ú j!t l!d!b!t f -l!f w!f o!x i f o!ú f l!g!bn f l!p!q!ýn vn l!po!ú f l!ýn f l!b!j!t l!t b!t l!bo!v!od!r!h!bs!jn bhf l!r!v!b!r!j!z-lú f l!h!f of sb!r!m!p!q!ýn vn l!jn bhf
 d!bo!cf l!t f r!hd!f e/
- 56 \1389^ B!t l!ef t!d!j!cf el!b!cp!w!f -l!b!ddpsejoh!up!ú f l!f j!h!ú l!boe!l!ojou lf n cpejn f ou!-l!cz!t f ý!j!oh!ú f l!t j!oh!r!l!s!f g!s!f odf l!g!bn f
 bt lú f l!s!f g!s!f odf l!pg!dpn qbs!t po!x!ú lú f l!g!bn f t l!g!pn l!b!q!r!m!s!r!j!z!l!pgt ps!f el!g!bn f t l!cbt f el!po!ú f l!di bsdúf stj ý!d!bn pvou
 boe!l!jn f l!dp!ss!f r!u!j!po!pgú f l!jn bhf -l!op!f s!ps!f l!b!ddv!n vr!uf el!ev!s!oh!ú f l!w!f d!ps!d!b!r!v!r!u!j!po!f!w!f o!x i f o!bo!v!od!r!h!bs!g!bn f
 f ý!jt ú -l!f y!d!f r!h!ou!t zou f t!jt l!d!bo!cf l!s!f b!r!j!f el!x!ú pv!b!oz!l!q!sc!r!h!n /
- \138: ^ B!t l!ps!b!h!f l!n f el!j!v!n l!x!j!m!of y!l!cf l!ef t!d!j!cf el!bt l!b!op!ú f sl!f n cpejn f ou!pgú f l!qsf t f ou!jowf o!j!po/
 \1391^ F!b!d! l!pgú f l!Q!t l!up!ojou lf n cpejn f ou!pgú f l!qsf t f ou!jowf o!j!po!d!bo!b!r!p!cf l!b!d!j!f w!f el!cz!l! b!s!ex bs!f l!dpot ý!w!j!po-
 ps!cz!l!b!dpn qv!f sl!t z!t úf n l!dpot ý!w!f el!pg!D!Q!V!boe!l!n f n ps!z/
- 66 \1392^ J!b!ú f l!dpot ý!w!j!po!pgú f l!dpn qv!f sl!t z!t úf n -lú f l!n f n ps!z!dpot ý!w!f t!ú f l!t ps!b!h!f l!n f el!j!v!n l!b!ddpsejoh!up!ú f
 qsf t f ou!jowf o!j!po!f!T!q!f d!j!Q!b!r!m!l!ú f l!p!ck!d!ú l!pgú f l!qsf t f ou!jowf o!j!po!d!bo!cf l!b!d!j!f w!f el!cz!l!v!t j!oh!jo!ú f l!t z!t úf n l!ps!ú f
 b!q!q!bs!b!wt l!ú f l!t ps!b!h!f l!n f el!j!v!n l!j!o!x i jdi lú f l!q!q!sh!bn l!dp!ef l!pgt!pg!x bs!f l!gs!f y!f dv!j!oh!ú f l!pq!f sb!j!ot l!ef t!d!j!cf el!jo!ú f
 f n cpejn f ou!l!t l!t ps!f e-l!boe!cz!l!s!f be!j!oh!boe!l!f y!f dv!j!oh!ú f l!q!q!sh!bn l!dp!ef l!t ps!f el!jo!ú f l!t ps!b!h!f l!n f el!j!v!n l!cz!lú f l!t z!t úf n

qjudi !jolt bje!qsf ef uf sn jof elsf t pmjupot -!boe!pvuqvujoh!u f !t f dpoe!n pūpo!w dups

- 6/ B!n f ū pel!b!ddpsejoh!up!drb!n !5-!x i f sf jolt bje!ef uf d!joh!t uf q-!u f !ovn cf slpgg!bn f t !cf ux f f o!u f !ux p!g!bn f t x i jdi !bsf !pckf dū !g!sef uf d!joh!t bje!qsf un pūpo!w dups!boe!cf !t x judi f eljo!b!ddpsebodf !x jū !bt !j! f !pgt bje!ef uf dū e qsf un pūpo!w dups
- 7/ B!n f ū pel!b!ddpsejoh!up!drb!n !3-!x i f sf jolt bje!ef uf d!joh!t uf q!dpn qst f t !t uf qt !pgf uf d!joh!t bje!n pūpo!w dups!vt joh bo!ps! p!pobrt!bot gsn !dpf gū!j!f ou!pcubjof elcz!ps! p!pobrt!bot gsn johl!t bje!ux p!g!bn f t !pg!n bhf t /
- 8/ B!n f ū pel!b!ddpsejoh!up!drb!n !7-!x i f sf jolt bje!ef uf d!joh!t uf q!dpn qst f t !t uf qt !pgf q!psn joh!uf n q!r!uf !n bdi joh cf ux f f o!t bje!ux p!g!bn f t !pg!n bhf t !up!spvhi !z!ef uf dū bje!n pūpo!w dups!boe!qsf !z!ef uf d!joh!t bje!n pūpo!w dups vt joh!u f !spvhi !ef uf dūpo!sf t vrd!boe!u f !ps! p!pobrt!bot gsn !dpf gū!j!f ou!pgt bje!ux p!g!bn f t /
- 9/ B!n f ū pel!b!ddpsejoh!up!drb!n !3-!x i f sf jolt bje!ef uf d!joh!t uf q!dpn qst f t !t uf qt !pgf uf d!joh!t f !n pūpo!w dups!cf ux f f o ū f !jn bhf !pgb!sf g sf od!f !g!bn f !bt !pof !pgb!q!msbr!z!pgg!bn f t !boe!u f !jn bhf !pgf bdi !pgū f !sf n bjo!joh!g!bn f t -!boe t bje!q!psn joh!t uf q!dpn qst f t !t uf qt !pgg!sn joh!u f !jn bhf !t zou f t !j! f el!polū f !jn bhf !pgt bje!sf g sf od!f !g!bn f !vt joh ū f !jn bhf !pgū f !dpss! t q!poe!joh!g!bn f !boe!u f !ef uf dū el!n pūpo!w dups
- 10/ B!n f ū pel!b!ddpsejoh!up!drb!n !9-!x i f sf jolt bje!q!ovujoh!t uf q!dpn qst f t !t uf qt !pgt f r!nd!joh!pof !g!bn f !bt !t bje!sf g sf od!f !g!bn f !g!pn !u f !q!msbr!z!p!ge!j!g sf ou!g!bn f t !joh!dpou!jovpvt !n pūpo!j!n bhf t !joh!b!ddpsebodf !x jū !u f !jn bhf !pgf bdi !g!bn f /
- 21/ B!n f ū pel!b!ddpsejoh!up!drb!n !-!x i f sf jolt bje!sf g sf od!f !g!bn f !jt !t f r!nd!f el!g!pn !t bje!q!msbr!z!pgg!bn f t !joh!b!ddpsebodf !x jū !f eh!f !t uf oh!t !pgū f !jn bhf t !jolt bje!q!msbr!z!pgg!bn f t /
- 22/ B!n f ū pel!b!ddpsejoh!up!drb!n !2-!x i f sf jolt bje!q!psn joh!t uf q!dpn qst f t !t uf qt !pgt zou f t !j! joh!bo!joh!f sq!rt!ū!p!j!n bhf gsn f elvt joh!pū f !s!jn bhf t !x jū !sf t qf dū!p!b!sf g sf od!f !jn bhf !bt !pof !pgt bje!q!msbr!z!pg!jn bhf t !up!qsf q!bs! !t bje of x !jn bhf /
- 23/ B!n f ū pel!b!ddpsejoh!up!drb!n !22-!x i f sf jolt bje!pū f !s!jn bhf !jt !vt f el!bt !j!jt !bt !t bje!joh!f sq!rt!ū!p!j!n bhf /
- 24/ B!n f ū pel!b!ddpsejoh!up!drb!n !22-!x i f sf jolt bje!joh!f sq!rt!ū!p!j!n bhf !jt !g!sn f elvt joh!t bje!sf g sf od!f !jn bhf !boe!t bje pū f !s!jn bhf t /
- 25/ B!n f ū pel!b!ddpsejoh!up!drb!n !24-!x i f sf jolt bje!joh!f sq!rt!ū!p!j!n bhf !jt !pcubjof elcz!t zou f t !j! joh!jog!psn b!ypo!sf hb!sejoh t bje!pū f !s!jn bhf t !up!jog!psn b!ypo!sf hb!sejoh!t bje!sf g sf od!f !jn bhf !joh!b!ddpsebodf !x jū !t bje!sf r!ū!w !qpt !j!pot /
- 26/ B!n f ū pel!b!ddpsejoh!up!drb!n !25-!x i f sf jolt bje!joh!f sq!rt!ū!p!j!n bhf !jt !pcubjof elcz!t zou f t !j! joh!b!di b!s!d!f q!t !j!d!w!bm!f pgt bje!sf g sf od!f !jn bhf !boe!di b!s!d!f q!t !j!d!w!bm!f t !pgt bje!pū f !s!jn bhf t !joh!b!ddpsebodf !x jū !t bje!sf r!ū!w !qpt !j!pot /
- 27/ B!n f ū pel!b!ddpsejoh!up!drb!n !25-!x i f sf jolt bje!joh!f sq!rt!ū!p!j!n bhf !jt !pcubjof elcz!t zou f t !j! joh!bo!ps! p!pobrt!bot . gsn !dpf gū!j!f ou!pcubjof el!g!pn !t bje!sf g sf od!f !jn bhf !boe!ps! p!pobrt!bot gsn !dpf gū!j!f ou!pcubjof el!g!pn !t bje!pū f !s !jn bhf t !joh!b!ddpsebodf !x jū !t bje!sf r!ū!w !qpt !j!pot /
- 28/ B!n f ū pel!b!ddpsejoh!up!drb!n !22-!x i f sf jolt bje!joh!f sq!rt!ū!p!j!n bhf !jt !pcubjof elcz!joh!f sq!rt!ū!j!n bhf !jog!psn b!ypo jolt bje!pū f !s!jn bhf t /
- 29/ B!n f ū pel!b!ddpsejoh!up!drb!n !28-!x i f sf jolt bje!joh!f sq!rt!ū!p!j!n bhf !jt !pcubjof elcz!joh!f sq!rt!ū!j!n bhf !jog!psn b!ypo sf hb!sejoh!t bje!pū f !s!jn bhf t !joh!b!ddpsebodf !x jū !t bje!sf r!ū!w !qpt !j!pot /
- 20/ B!n f ū pel!b!ddpsejoh!up!drb!n !22-!x i f sf jolt bje!joh!q!ovujoh!t uf q!dpn qst f t !t uf qt !pgt f r!nd!joh!pof !jn bhf !bt !t bje!sf g sf od!f !jn bhf !g!pn !t bje!q!msbr!z!pg!jn bhf t !joh!b!ddpsebodf !x jū !f bdi !jn bhf /
- 31/ B!n f ū pel!b!ddpsejoh!up!drb!n !2-!x i f sf jolt bje!sf g sf od!f !jn bhf !jt !t f r!nd!f el!g!pn !t bje!q!msbr!z!pg!jn bhf t !joh!b!ddpse bodf !x jū !jn bhf !f eh!f !t uf oh!t !jolt bje!q!msbr!z!pg!jn bhf t /
- 32/ B!n f ū pel!b!ddpsejoh!up!drb!n !2-!x i f sf jolt bje!sf g sf od!f !jn bhf !jt !t f r!nd!f el!g!pn !t bje!q!msbr!z!pg!jn bhf t !joh!b!ddpse bodf !x jū !joh!q!v!p!sef slpgt bje!q!msbr!z!pg!jn bhf t /

33/ Boljn bhf !qspdf t t joh!n f u pe-ldpn qst joh!t f qt !pg

)b"!joqvujoh!b!qmsbrjz!pgn vwbmlejjf sf oujn bhf t !i bwjoh!qsf ef uf sn jof e!sf t pmjpot <
)c"!gpn joh!boljof sqpruipoljn bhf !gpn lu f !qmsbrjz!pgjn bhf t <boe
)d"!gpn joh!bof x ljn bhf !i bwjoh!bli jhi !sf t pmjpot!bt ldpn qbsf elx ju !t bje!qsf ef uf sn jof e!sf t pmjpot !cz!t i jgjo
boe!t zou f t j!joh!u f !jof sqpruipoljn bhf !x ju !sf t qf dup!b!sf g sf od f ljn bhf !bt !pof !pgt bje!qmsbrjz!pgjn bhf t
x ju !b!sf t pmjpot!rft t !u bo!b!qjyf r!judi !jolt bje!qsf ef uf sn jof e!sf t pmjpot /

34/ B!n f u pe!bddpsejoh!up!drjn !33-!gys i f s!dpn qst joh!bt f q!pgf uf djo!sf r!ujw !qpt j!pot !bn poh!u f !qmsbrjz!pg
jn bhf t !boe!x i f sf jolt bje!t f !g!bn pvoudpgt bje!jof sqpruipoljn bhf !x ju !sf t qf dup!t bje!sf g sf od f ljn bhf !jt !ef uf sn jof e
joltbddpsebodf !x ju !u f !sf r!ujw !qpt j!pot /

35/ B!n f u pe!bddpsejoh!up!drjn !34-!x i f sf jolt bje!t f q!pgpn joh!u f !jof sqpruipoljn bhf !dpn qst f t !t f qt !pgt zou f .
t j!joh!psi phpobrtubot gsn !dpf g!ujf out !pcubjof e!gpn !t bje!qmsbrjz!pgjn bhf t !p!pcubjolt bje!jof sqpruipoljn bhf /

36/ B!n f u pe!bddpsejoh!up!drjn !35-!x i f sf jolt bje!t f t zou f t j!joh!pgt bje!psi phpobrtubot gsn !dpf g!ujf out !jt !qf sgn f e
x ju !b!sbj!p!gsl!b!sf r vf odz!b!sf b!pgf bdi !psi phpobrtubot gsn !dpf g!ujf out

37/ B!n f u pe!bddpsejoh!up!drjn !36-!x i f sf jolt bje!t f t zou f t j!joh!pgt bje!psi phpobrtubot gsn !dpf g!ujf out !jt !qf sgn f e
cz!t f r!udjoh!u f !psi phpobrtubot gsn !dpf g!ujf out !pcubjof e!gpn !t bje!qmsbrjz!pgjn bhf t !joltbddpsebodf !x ju !u f
g f r vf odz!b!sf b!pgf bdi !psi phpobrtubot gsn !dpf g!ujf out

38/ Boljn bhf !qspdf t t joh!n f u pe-ldpn qst joh!t f qt !pg

)b"!f yusbujoh!b!qmsbrjz!pggn f t !gpn !n p!jpoljn bhf t !i bwjoh!qsf ef uf sn jof e!sf t pmjpot <
)c"!dbtrvrbjoh!psi phpobrtubot gsn !dpf g!ujf out !pgf bdi !pgjn bhf t !jolt f !qmsbrjz!pggn f t <boe
)d"!ef uf djo!n p!jpolw d!ps !bn poh!t bje!qmsbrjz!pggn f t !x ju !b!sf t pmjpot!rft t !u bo!b!qjyf r!judi !jolt bje
qsf ef uf sn jof e!sf t pmjpot !cz!vt joh!u f !psi phpobrtubot gsn !dpf g!ujf out /

39/ B!n f u pe!bddpsejoh!up!drjn !38-!x i f sf jolt bje!t f uf djo!t f q!dpn qst f t !t f qt !pgqf sgn joh!u n qrtu! !n budi joh
cf ux f o!t bje!x p!gpn f t !pgjn bhf t !p!spvhi r!ef uf d!t bje!n p!jpolw d!ps!boe!Cof r!ef uf djo!t bje!n p!jpolw d!ps
vt joh!u f !spvhi !ef uf d!jolt f vndboe!u f !psi phpobrtubot gsn !dpf g!ujf out !pgt bje!x p!gpn f t /

3: / Boljn bhf !qspdf t t joh!n f u pe-ldpn qst joh!t f qt !pg

)b"!joqvujoh!b!qmsbrjz!pgn vwbmlejjf sf oujn bhf t !i bwjoh!qsf ef uf sn jof e!sf t pmjpot <
)c"!dbtrvrbjoh!psi phpobrtubot gsn !dpf g!ujf out !pgf bdi !pgu f !qmsbrjz!pgjn bhf t <boe
)d"!t i jgjo!boe!t zou f t j!joh!t bje!qmsbrjz!pgjn bhf t !x ju !b!sf t pmjpot!rft t !u bo!b!qjyf r!judi !jolt bje!qsf ef uf s
n jof e!sf t pmjpot !cz!vt joh!u f !psi phpobrtubot gsn !dpf g!ujf out /

41/ B!n f u pe!bddpsejoh!up!drjn !3: -!gys i f s!dpn qst joh!bt f q!pgf uf djo!sf r!ujw !qpt j!pot !bn poh!t bje!qmsbrjz!pg
jn bhf t !boe!x i f sf jolt bje!t zou f t j!joh!t f q!dpn qst f t !t f qt !pgt zou f t j!joh!t bje!qmsbrjz!pgjn bhf t !joltbddpsebodf
x ju !t bje!sf r!ujw !qpt j!pot /

42/ B!n f u pe!bddpsejoh!up!drjn !41-!x i f sf jolt bje!t zou f t j!joh!t f q!u f !t zou f t j!joh!pgu f !psi phpobrtubot gsn
dpf g!ujf out !jolt bje!qmsbrjz!pgjn bhf t !jt !qf sgn f elx ju !b!sbj!p!gsl!b!sf r vf odz!b!sf b!pgf bdi !pgu f !psi phpobm
ubot gsn !dpf g!ujf out /

43/ B!n f u pe!bddpsejoh!up!drjn !42-!x i f sf jolt bje!t zou f t j!joh!pgt bje!psi phpobrtubot gsn !dpf g!ujf out !jt !qf sgn f e
cz!t f r!udjoh!u f !psi phpobrtubot gsn !dpf g!ujf out !pcubjof e!gpn !t bje!qmsbrjz!pgjn bhf t !joltbddpsebodf !x ju !u f
g f r vf odz!b!sf b!pgf bdi !psi phpobrtubot gsn !dpf g!ujf out

44/ Boljn bhf !qspdf t t joh!bqqbswt -ldpn qst joh;

)b"!joqvun f bot !gsljoqvujoh!b!qmsbrjz!pgn vwbmlejjf sf oujn bhf t !i bwjoh!qsf ef uf sn jof e!sf t pmjpot <
)c"!ef uf djo!n f bot !gsl ef uf djo!sf r!ujw !qpt j!pot !bn poh!u f !qmsbrjz!pgjn bhf t !x ju !b!sf t pmjpot!rft t !u bo
b!qjyf r!judi !jolt bje!qsf ef uf sn jof e!sf t pmjpot <boe
)d"!gpn joh!n f bot !gsl gpn joh!bof x ljn bhf !i bwjoh!bli jhi !sf t pmjpot!bt ldpn qbsf elx ju !t bje!qsf ef uf sn jof e

sf t pmuipot lczlvt joh!t bje!qmsbrjz!pgjn bhf t !jo!bddpsebodf !x ju !jogpsn bypo!joejdbujoh!u f !sf raijwf !qpt jupot
gpn !u f !ef u djojn f bot /

45/ Bolbqqbswt !bddpsejoh!up!drbjn !44-!x i f sf jolt bje!qmsbrjz!pgjn bhf t !sf raijwf !up!ux plejg sf oulgn f t !jo!n vwbm
6 dpoiovpt !n pypoljn bhf t !boe!t bje!ef u djojn f bot !ef u du !u f !jogpsn bypo!joejdbujoh!t bje!sf raijwf !qpt jupot !bt
b!n pypolwf dups

46/ Bolbqqbswt !bddpsejoh!up!drbjn !45-!x i f sf jolt bje!ef u djojn f bot !ef u du !t bje!n pypolwf dupsvt joh!psi phpbm
21 usbot gsn !dpf gijf ou !pcbjof e!cz!psi phpbm!usbot gsn joh!t bje!ux p!gn f t !pgjn bhf t /

47/ Bolbqqbswt !bddpsejoh!up!drbjn !44-!x i f sf jolt bje!psn joh!n f bot !t zou f t j!f t !boljof sqpruipoljn bhf !psn f elvt joh
pu f sijn bhf t !x ju !sf t qf dulp!b!sf g sf odf !jn bhf !bt !pof !pgt bje!qmsbrjz!pgjn bhf t !up!qsf qbsf !t bje!of x !jn bhf /

48/ Bolbqqbswt !bddpsejoh!up!drbjn !47-!x i f sf jolt bje!psn joh!n f bot !t zou f t j!f t !jogpsn bypo!sf hbsejoh!t bje!pu f s
26 jn bhf t !x ju !sf t qf dulp!jogpsn bypo!sf hbsejoh!t bje!sf g sf odf !jn bhf !jo!bddpsebodf !x ju !t bje!sf raijwf !qpt jupot !up
pcbjolt bje!jof sqpruipoljn bhf /

49/ Bolbqqbswt !bddpsejoh!up!drbjn !48-!x i f sf jolt bje!psn joh!n f bot !t zou f t j!f t !bolpsi phpbm!usbot gsn !dpf gijf ou
31 pcbjof e!gn !t bje!sf g sf odf !jn bhf !boe!psi phpbm!usbot gsn !dpf gijf ou !pcbjof e!gn !t bje!pu f sijn bhf t !jo
bddpsebodf !x ju !t bje!sf raijwf !qpt jupot !up!pcbjolt bje!jof sqpruipoljn bhf /

4: / Boljn bhf !qpdf t t joh!bqqbswt !dpn qst joh;

36)b*!joqvujoh!n f bot !gs!joqvujoh!b!qmsbrjz!pgn vwbm!ejg sf oujn bhf t !i bwjoh!qsf ef u sn jof e!sf t pmuipot <
)c*!t ugn joh!n f bot !gs!gn joh!boljof sqpruipoljn bhf !gn !u f !qmsbrjz!pgjn bhf t <boe
)d*!t f dpoe!gn joh!n f bot !gs!gn joh!blof x !jn bhf !i bwjoh!b!jhi !sf t pmuipot!bt !dpn qbsf elx ju !t bje!qsf ef u s
n jof e!sf t pmuipot !-cz!t i jgjh!boe!t zou f t j!f t !joh!u f !jof sqpruipoljn bhf !x ju !sf t qf dulp!b!sf g sf odf !jn bhf !bt
pof !pgt bje!qmsbrjz!pgjn bhf t !x ju !b!sf t pmuipolrht t !u bol!qjyf raijudi !jolt bje!qsf ef u sn jof e!sf t pmuipot /

51/ Bolbqqbswt !bddpsejoh!up!drbjn !4: -!g!su f sdpn qst joh!ef u djojn f bot !gs!ef u djojn!sf raijwf !qpt jupot !bn poh!u f
41 qmsbrjz!pgjn bhf t !-boe!x i f sf jolt bje!t f dpoe!gn joh!n f bot !ef u sn jof t !bt i jg!bn pvoupdt bje!jof sqpruipoljn bhf
x ju !sf t qf dulp!t bje!sf g sf odf !jn bhf !jo!bddpsebodf !x ju !u f !sf raijwf !qpt jupot /

52/ Bolbqqbswt !bddpsejoh!up!drbjn !51-!x i f sf jolt bje!t ugn joh!n f bot !t zou f t j!f t !psi phpbm!usbot gsn !dpf gijf ou
46 pcbjof e!gn !t bje!qmsbrjz!pgjn bhf t !up!pcbjolt bje!jof sqpruipoljn bhf /

53/ Boljn bhf !qpdf t t joh!ef wdf !-dpn qst joh;

51)b*!f yusbujoh!n f bot !gs!f yusbujoh!b!qmsbrjz!pggn f t !gn !n pypoljn bhf t !i bwjoh!qsf ef u sn jof e!sf t pmuipot <
)c*!dbdrvrujoh!n f bot !gs!dbdrvrujoh!psi phpbm!usbot gsn !dpf gijf ou !pgf bdi !pgjn bhf t !jo!u f !qmsbrjz!pg
gn f t <boe
)d*!ef u djojn f bot !gs!ef u djojn pypolwf dups !bn poh!t bje!qmsbrjz!pggn f t !x ju !b!sf t pmuipolrht t !u bol!b
qjyf raijudi !jolt bje!qsf ef u sn jof e!sf t pmuipot !-cz!vt joh!u f !psi phpbm!usbot gsn !dpf gijf ou /

54/ Boljn bhf !qpdf t t joh!ef wdf !-dpn qst joh;

61)b*!joqvujoh!n f bot !gs!joqvujoh!b!qmsbrjz!pgn vwbm!ejg sf oujn bhf t !i bwjoh!qsf ef u sn jof e!sf t pmuipot <
)c*!dbdrvrujoh!n f bot !gs!dbdrvrujoh!psi phpbm!usbot gsn !dpf gijf ou !pgf bdi !pgu f !qmsbrjz!pgjn bhf t <boe
)d*!t zou f t j!f t !joh!n f bot !gst i jgjh!boe!t zou f t j!f t !joh!t bje!qmsbrjz!pgjn bhf t !x ju !b!sf t pmuipolrht t !u bol!qjyf m
qjudi !jolt bje!qsf ef u sn jof e!sf t pmuipot !-cz!vt joh!u f !psi phpbm!usbot gsn !dpf gijf ou /

55/ B!sf dpsejoh!n f ejvn !sf bebrn!cz!b!dpn qv!f s!x i jdi !t up!f t !b!qshsn !gs!qf gsn joh!b!qpdf t t joh!qpdf t t !dpn .
qst joh!t u q! !pg

66)b*!joqvujoh!b!qmsbrjz!pgn vwbm!ejg sf oujn bhf t !i bwjoh!qsf ef u sn jof e!sf t pmuipot <
)c*!ef u djojn!sf raijwf !qpt jupot !pgu f !qmsbrjz!pgjn bhf t !x ju !b!sf t pmuipolrht t !u bol!qjyf raijudi !jolt bje!qsf ef .
u sn jof e!sf t pmuipot <boe
)d*!gn joh!blof x !jn bhf !i bwjoh!b!jhi !sf t pmuipot!bt !dpn qbsf elx ju !t bje!qsf ef u sn jof e!sf t pmuipot !vt joh!t bje

qmsbrjz!pgjn bhf t !jo!bddpæbodf !x jü !jogsn býpo!joejdbýoh!ü f !sf rúywf !qpt jýpot !pcubjof e!jo!ü f !ef úf djoh
t úf q/

56/ B!sf dpæjoh!n f ejvn !sf bebcrl!cz!b!dpn qvuf slx i jdi !t upsf t !b!qspshbn !gslqf sgnsn joh!b!qspdf t t joh!qspdf t t !dpn .
qst joh!t úf qt !pg

)b*!joqvujoh!b!qmsbrjz!pgn vwbm!ejgf sf oujn bhf t !i bwjoh!qsf ef úf sn jof e!sf t pmýpot <
)c*!gpn joh!bo!jouf sqprúypo!jn bhf !gpn !ü f !qmsbrjz!pgjn bhf t <bøe
)d*!gpn joh!blof x !jn bhf !i bwjoh!b!i jhi !sf t pmýpot!bt !dpn qbsf ebx jü !t bje!qsf ef úf sn jof e!sf t pmýpot -!cz!t i jgjo
boelt zou f t j!joh!ü f !jouf sqprúypo!jn bhf !x jü !sf t qf dúp!b!sf g sf odf !jn bhf !bt !pof !pgt bje!qmsbrjz!pgjn bhf t
x jü !b!sf t pmýpot!rft t !ü bo!b!qjyf rtajudi !jolt bje!qsf ef úf sn jof e!sf t pmýpot /

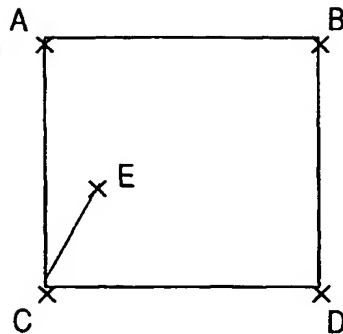
57/ B!sf dpæjoh!n f ejvn !sf bebcrl!cz!b!dpn qvuf slx i jdi !t upsf t !b!qspshbn !gslqf sgnsn joh!b!qspdf t t joh!qspdf t t !dpn .
qst joh!t úf qt !pg

)b*!f yubdjoh!b!qmsbrjz!pggn f t !gpn !n pýpo!jn bhf t !i bwjoh!qsf ef úf sn jof e!sf t pmýpot <
)c*!dbrdvrtajoh!psi phpobrtæbot gsn !dpf gújf ou !pgf bdi !pgjn bhf t !jo!ü f !qmsbrjz!pggn f t <bøe
)d*!ef úf djoh!n pýpo!wf dúst !bn poh!t bje!qmsbrjz!pggn f t !x jü !b!sf t pmýpot!rft t !ü bo!b!qjyf rtajudi !jolt bje
qsf ef úf sn jof e!sf t pmýpot -!cz!vt joh!ü f !psi phpobrtæbot gsn !dpf gújf ou /

58/ B!sf dpæjoh!n f ejvn !sf bebcrl!cz!b!dpn qvuf slx i jdi !t upsf t !b!qspshbn !gslqf sgnsn joh!b!qspdf t t joh!qspdf t t !dpn .
qst joh!t úf qt !pg

)b*!joqvujoh!b!qmsbrjz!pgn vwbm!ejgf sf oujn bhf t !i bwjoh!qsf ef úf sn jof e!sf t pmýpot <
)c*!dbrdvrtajoh!psi phpobrtæbot gsn !dpf gújf ou !pgf bdi !pgü f !qmsbrjz!pgjn bhf t <bøe
)d*!t i jgjo!boelt zou f t j!joh!t bje!qmsbrjz!pgjn bhf t !x jü !b!sf t pmýpot!rft t !ü bo!b!qjyf rtajudi !jolt bje!qsf ef úf s
n jof e!sf t pmýpot -!cz!vt joh!ü f !psi phpobrtæbot gsn !dpf gújf ou /

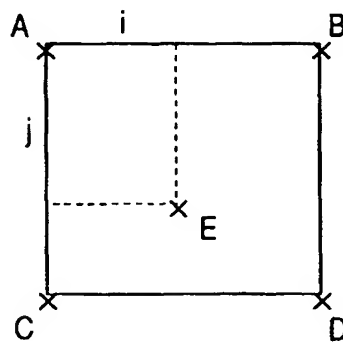
59/ Jh bhf !qspdf t t joh!bqqbswt !gsgsn joh!b!Cbrtjn bhf !x jü !b!sf t pmýpo!i jhi f slü bo!bo!joqvujn bhf -!ü f !bqqbswt
dpn qst joh!n f bot !gslf úf djoh!n pýpo!wf dúst !cf ux f f o!gpn f t !pgb!n pwjoh!jn bhf -!boeljouf sqprúypo!n f bot !vü.
rtajoh!ejwef e!n pýpo!wf dúst !gsljouf sqprújoh!qjyf rtajoup!pof !pgt bje!gpn f t /

FIG. 1

$$J = \min(|A-E|, |B-E|, |C-E|, |D-E|) = |X-E|$$

(J IS MINIMUM DISTANCE FROM INTERPOLATION
POINT TO OBSERVATION POINT.
X REPRESENTS OBSERVATION POINT WHICH
RESULTS IN MINIMUM DISTANCE.)

INTERPOLATION POINT $E=X$

FIG. 2

$$\text{INTERPOLATION POINT } E = (1-i)(1-j)A + i \cdot (1-j)B + j \cdot (1-i)C + ijD$$

FIG. 3

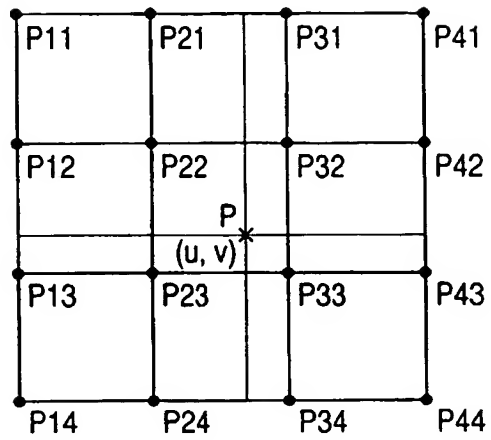


FIG. 5

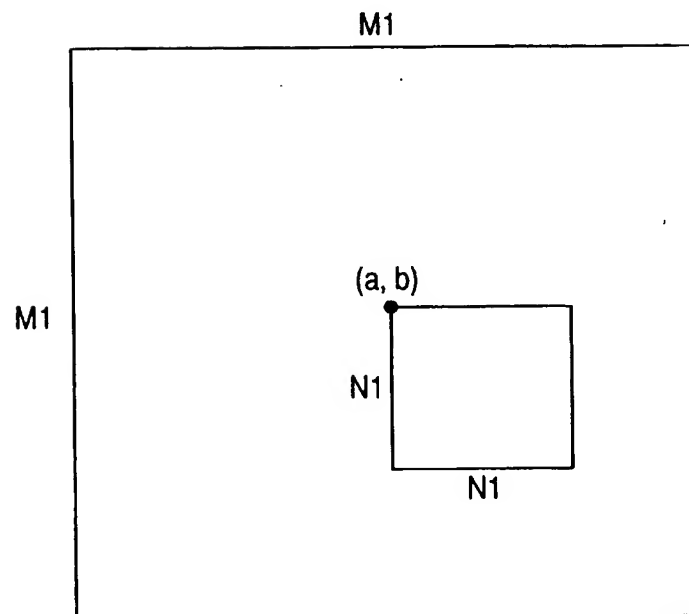


FIG. 4

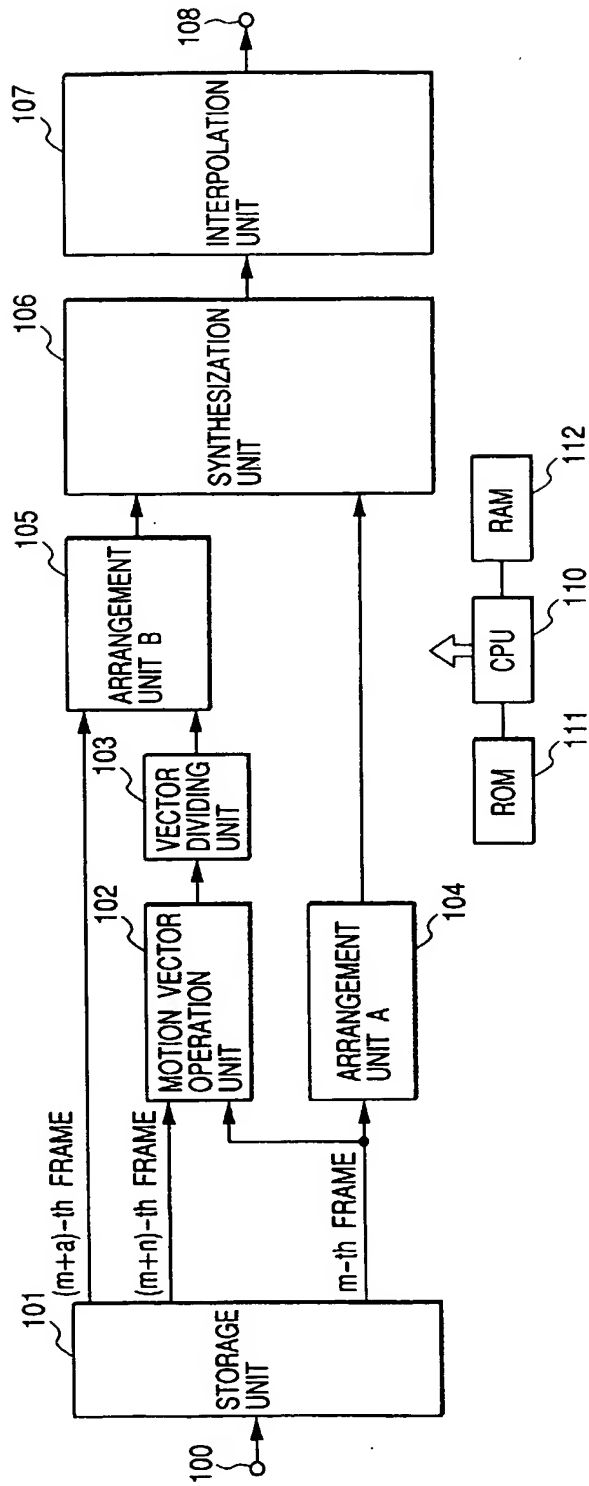
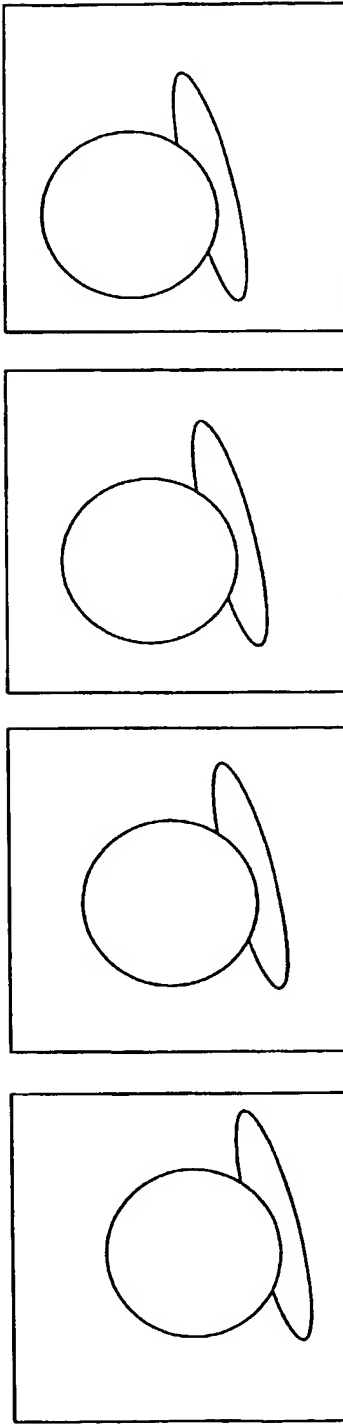


FIG. 6A FIG. 6B FIG. 6C FIG. 6D



(m+3)-th FRAME

(m+2)-th FRAME

(m+1)-th FRAME

m-th FRAME

FIG. 7A

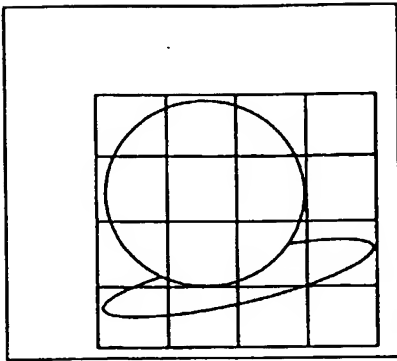


FIG. 7B

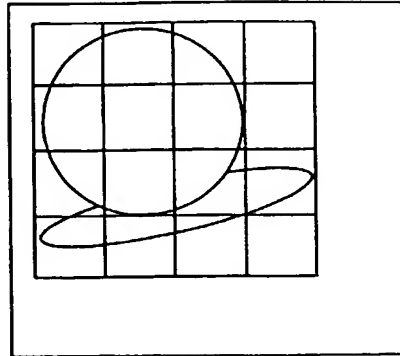


FIG. 7C

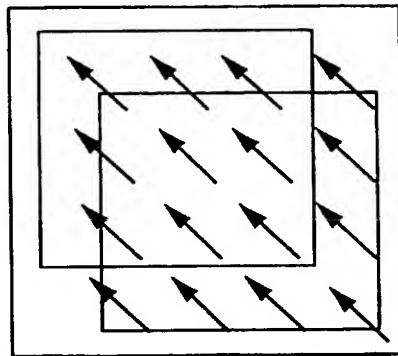


FIG. 8A

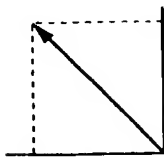


FIG. 8B

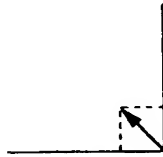


FIG. 8C

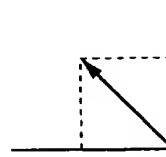


FIG. 9D

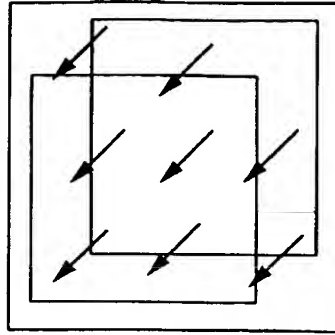


FIG. 9C

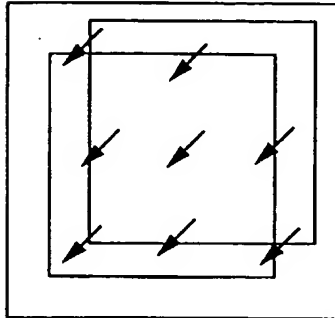


FIG. 9B

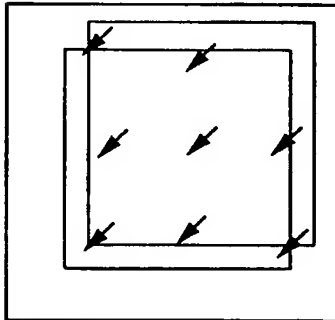


FIG. 9A

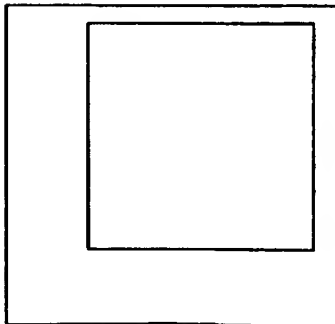


FIG. 10C

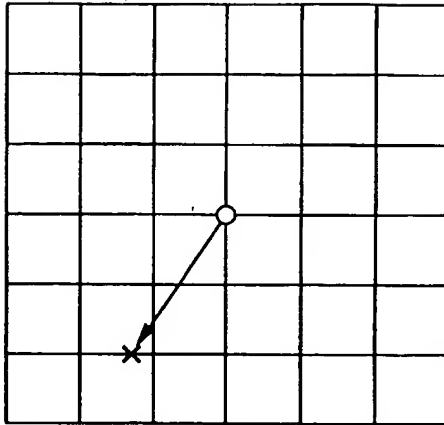


FIG. 10B

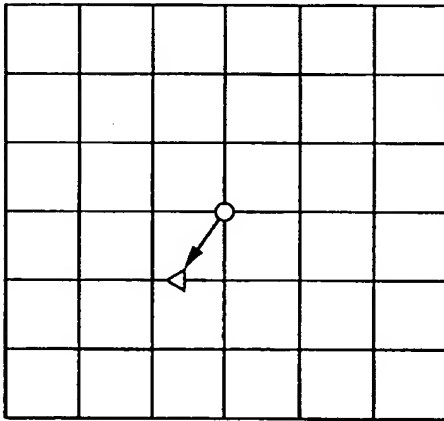


FIG. 10A

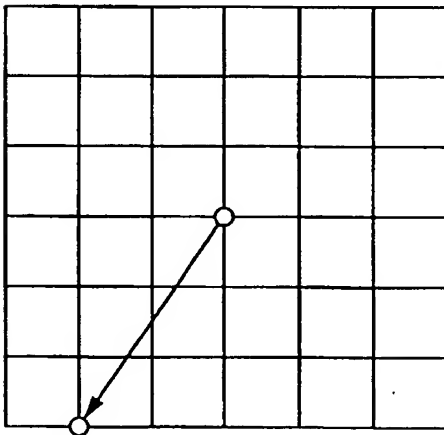
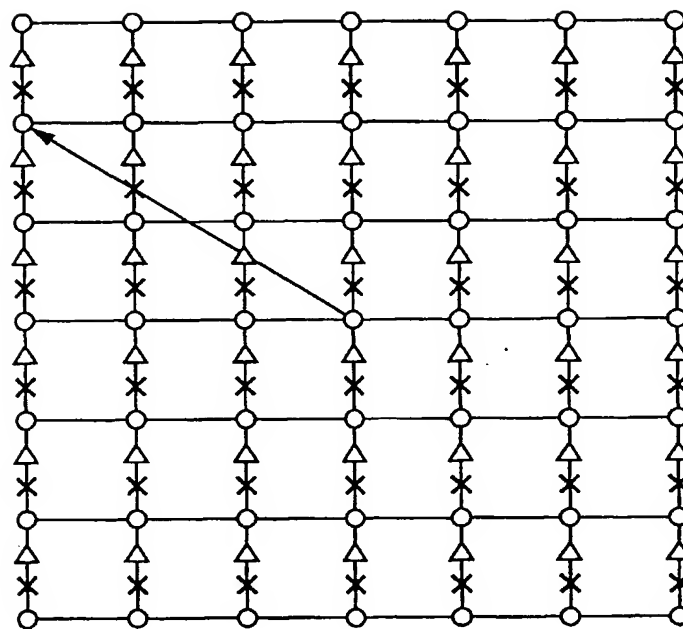


FIG. 11

○ : m-th FRAME
△ : (m+1)-th FRAME
× : (m+2)-th FRAME

FIG. 12

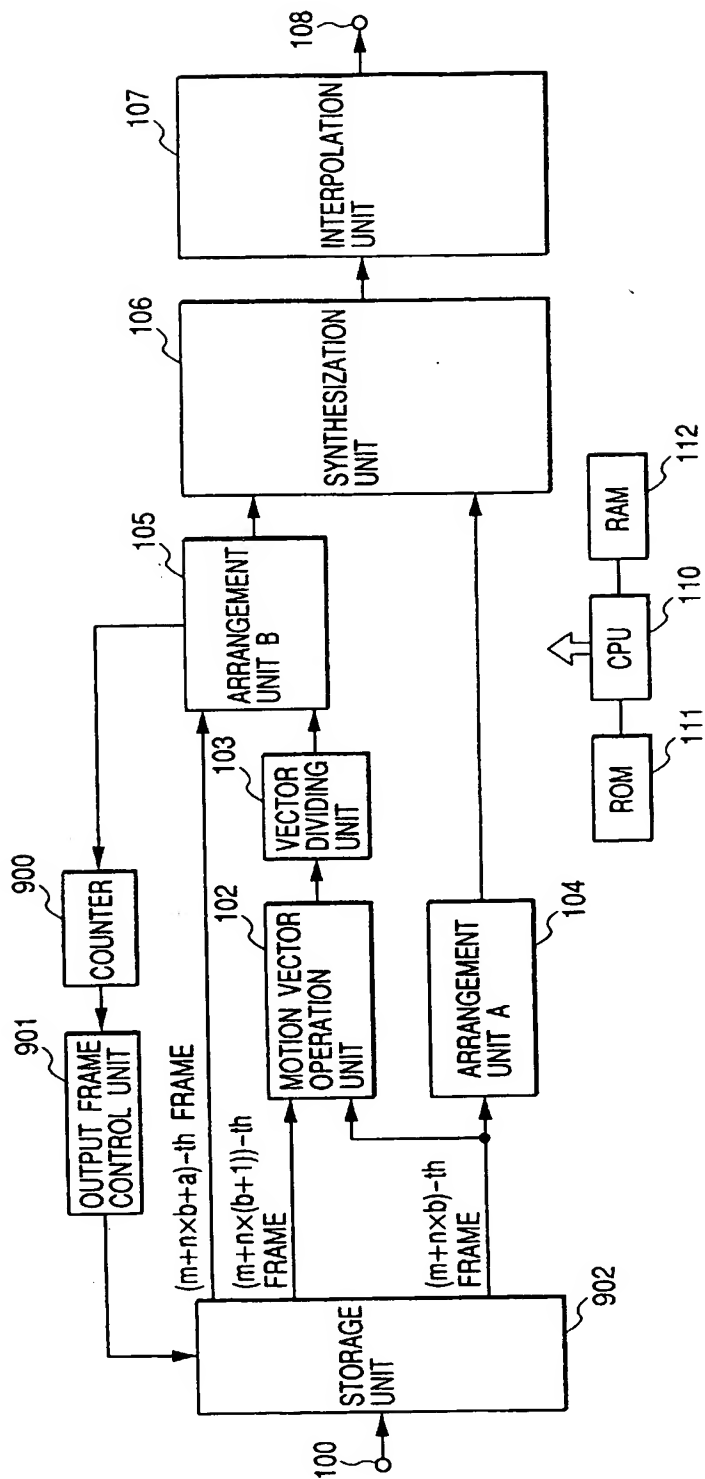


FIG. 13

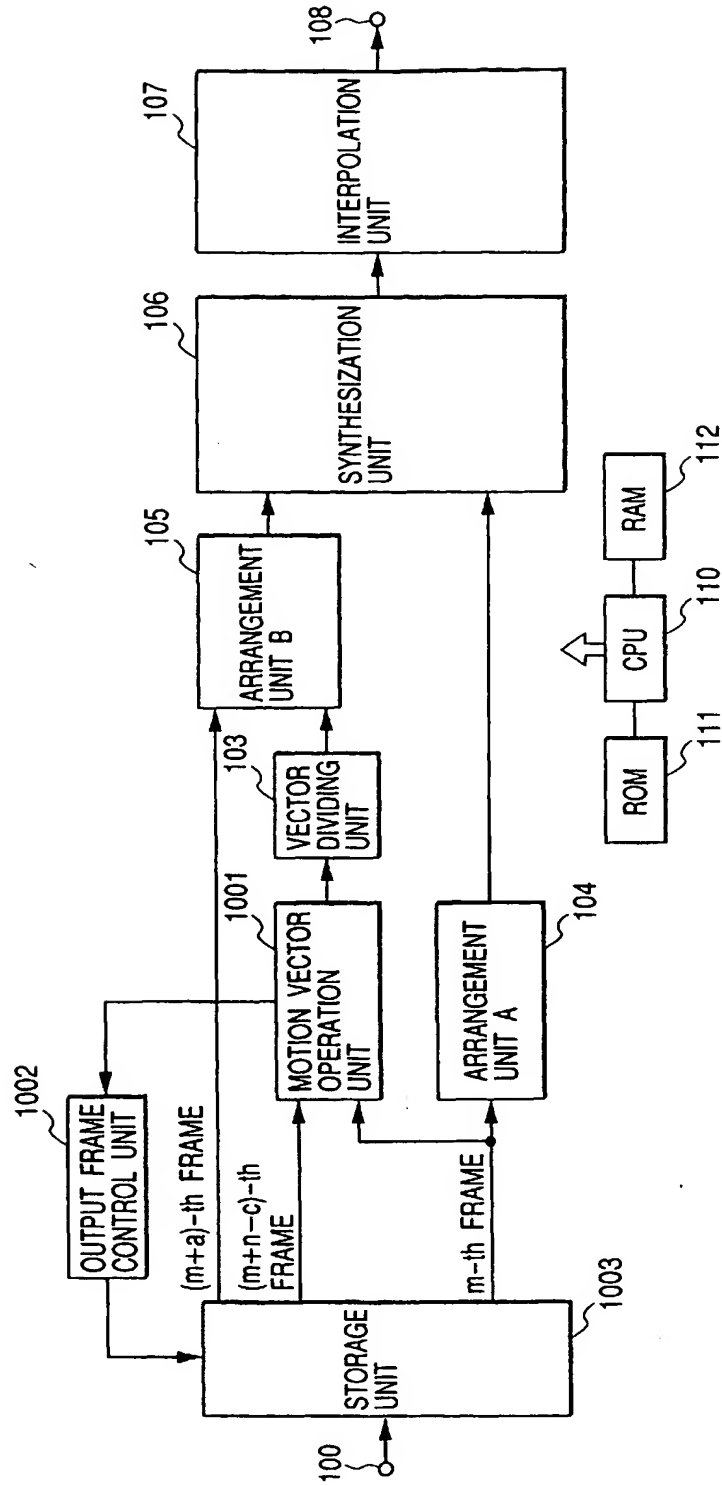


FIG. 14

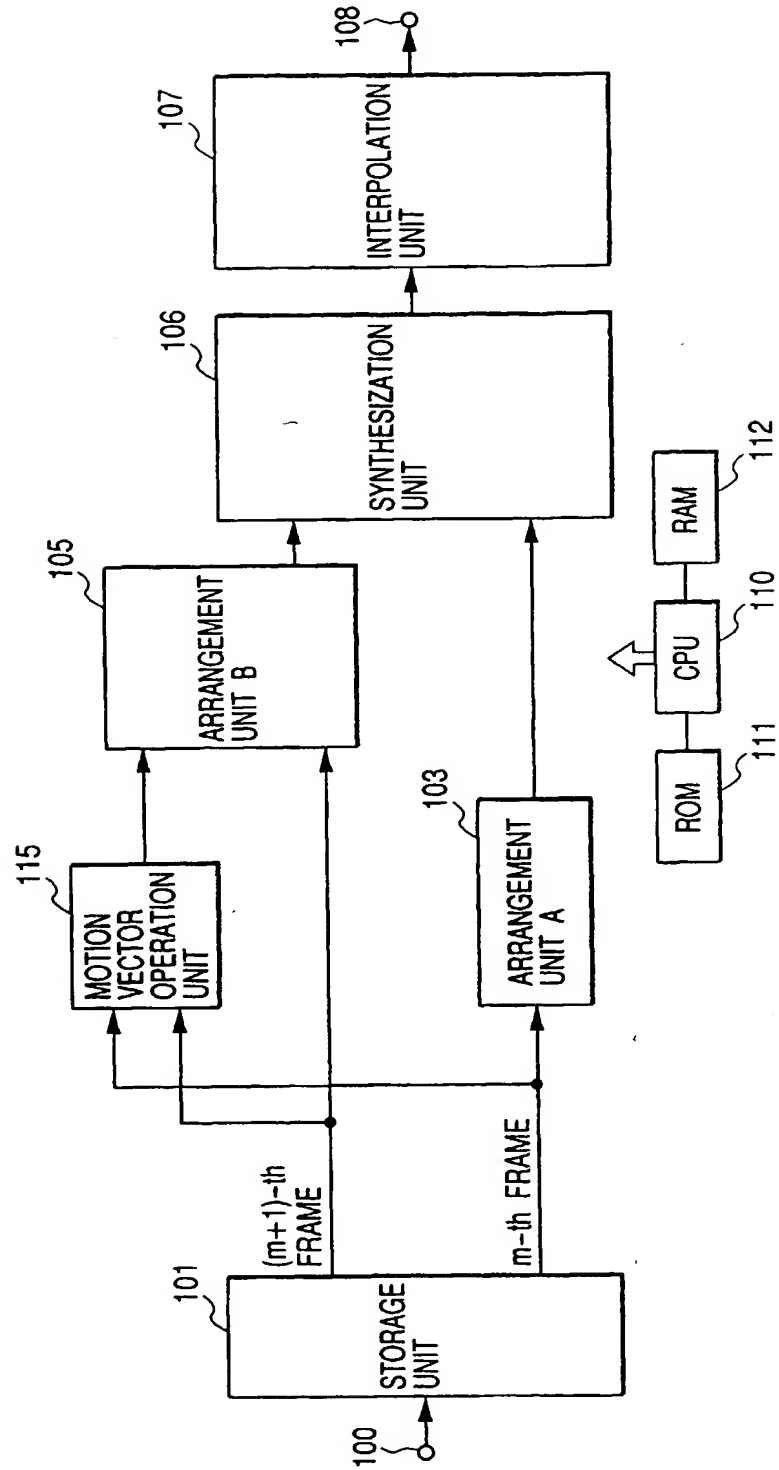


FIG. 15

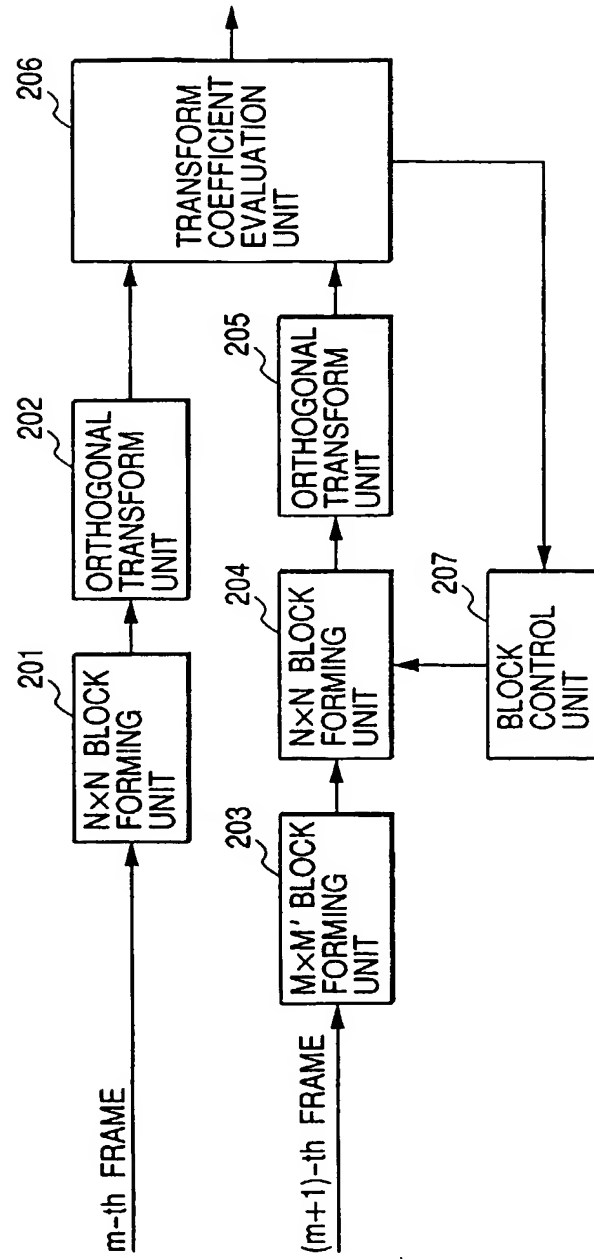


FIG. 16

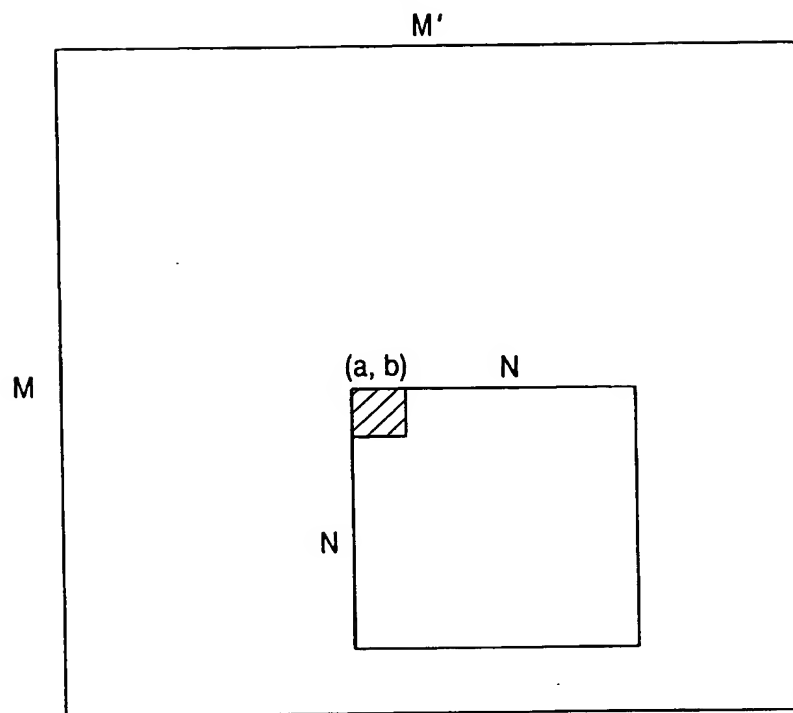


FIG. 18

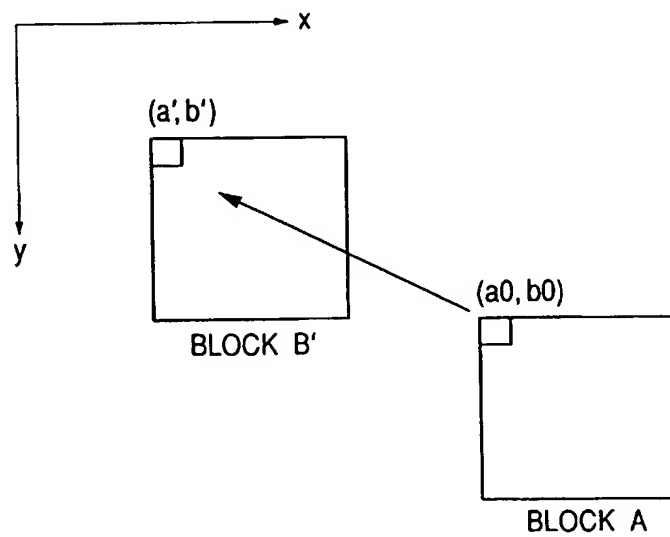


FIG. 17

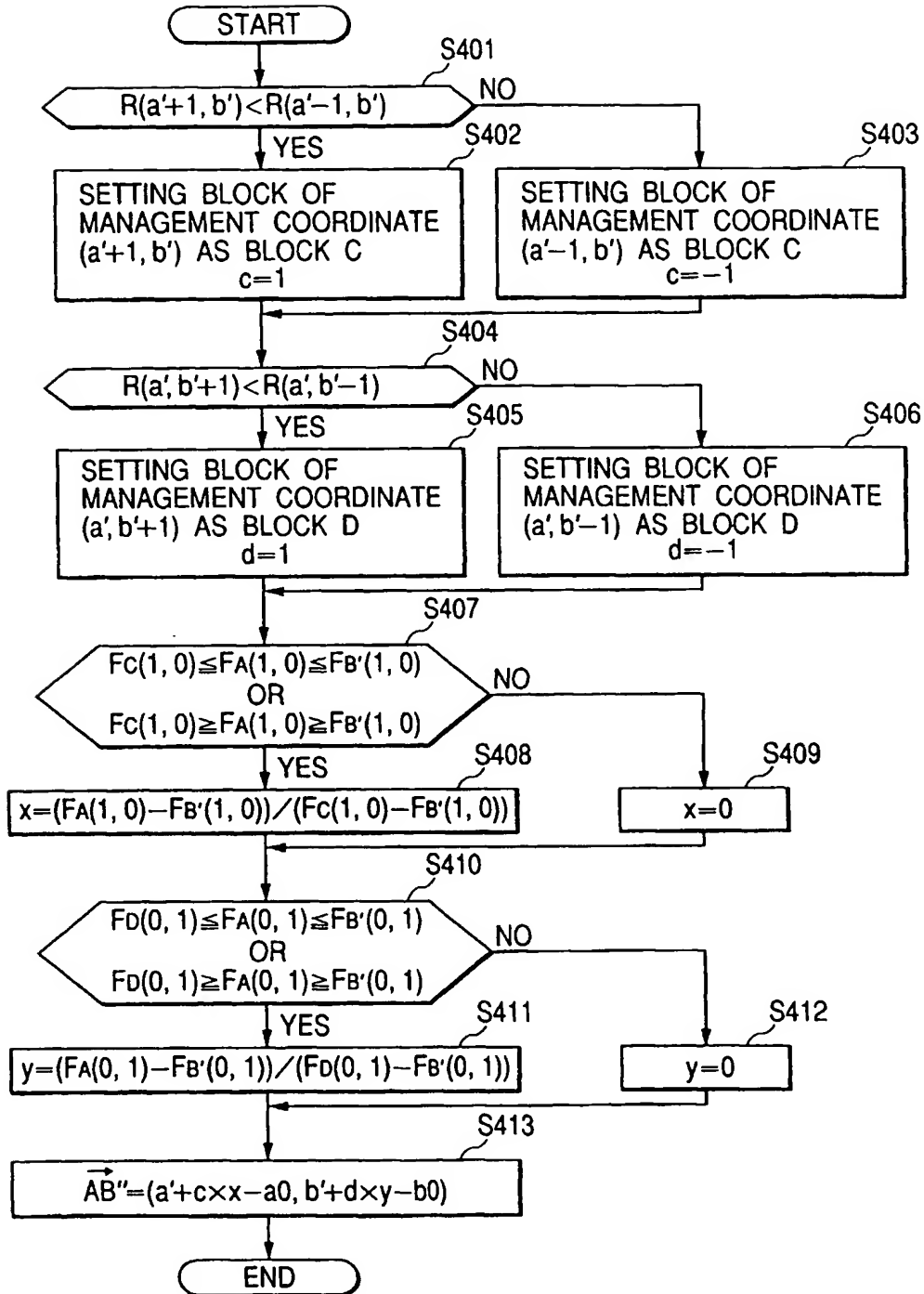


FIG. 19B

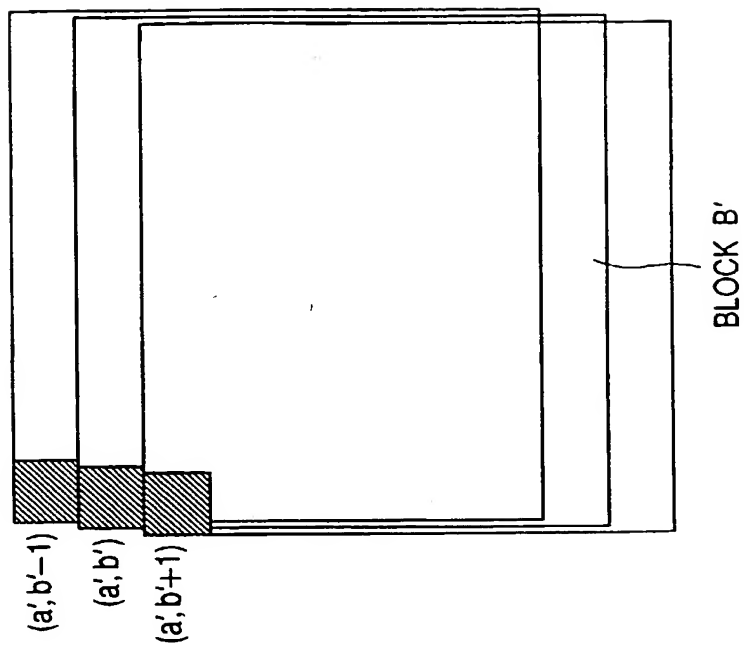


FIG. 19A

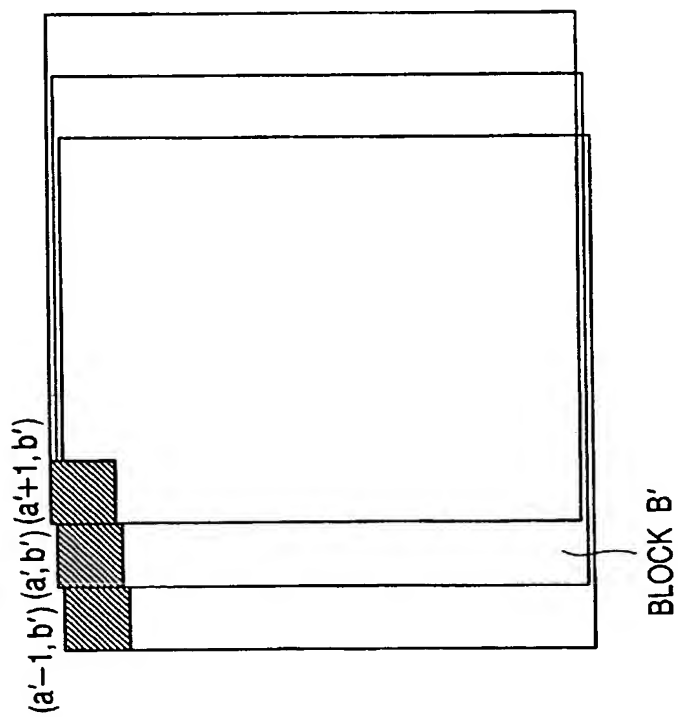


FIG. 20

BLOCK A							
IN							
63	56	60	54	52	50	46	47
62	73	73	75	83	90	96	99
81	91	99	105	112	117	121	120
102	103	102	103	105	109	110	111
125	121	116	111	112	110	106	103
134	140	140	120	110	106	105	101
137	142	147	137	112	107	105	97
144	145	145	140	114	106	100	88
DCT							
824.50	36.37	-6.21	-10.28	-9.75	3.45	0.68	-0.24
-157.84	-80.37	7.36	9.76	4.70	-8.01	1.05	2.59
-66.66	32.40	-7.42	-6.94	0.17	6.01	0.76	-1.86
-45.08	35.71	8.77	0.01	-0.79	-1.72	4.12	3.75
-34.75	22.78	2.11	9.37	7.00	2.06	1.83	-0.83
-9.14	8.40	-2.99	-4.30	0.91	3.82	2.45	-0.25
4.34	7.21	-3.24	-0.46	-0.88	0.00	1.42	2.25
7.66	-0.48	-6.23	2.47	2.52	2.11	0.42	0.04

~ 701

~ 702

FIG. 21

BLOCK B'							
IN							
65	54	59	56	52	50	46	45
57	73	72	75	82	87	95	99
80	87	98	105	110	115	121	122
102	103	102	103	105	109	110	111
127	124	116	111	112	110	107	103
132	140	142	124	112	106	105	101
136	140	148	140	116	107	105	97
144	145	146	141	114	106	103	86
DCT							
824.50	35.50	-9.34	-12.17	-8.25	5.78	-1.00	0.11
-162.46	-80.86	9.85	9.29	5.72	-8.08	1.59	1.36
-67.59	32.17	-9.69	-6.17	0.37	8.03	0.26	-1.26
-42.10	37.82	6.31	0.84	0.07	-2.33	3.76	2.95
-32.75	25.75	4.94	13.23	5.00	3.22	1.47	-1.08
-8.12	7.79	-4.68	-2.64	3.71	5.04	4.64	0.45
4.72	6.92	-2.74	-0.36	-0.42	2.69	2.69	1.94
8.08	-0.45	-4.05	3.94	3.89	3.05	1.09	0.48

~ 711

~ 712

FIG. 22

BLOCK C							
IN							
54	59	56	52	50	46	45	53
73	72	75	82	87	95	99	99
87	98	105	110	115	121	122	116
103	102	103	105	109	110	111	112
124	116	111	112	110	107	103	103
140	142	124	112	106	105	101	99
140	148	140	116	107	105	97	96
145	146	141	114	106	103	86	88
DCT							
814.87	41.46	6.37	-1.61	-8.62	-6.73	2.64	-1.23
-134.83	-84.34	-9.12	1.20	8.46	5.17	-4.66	-0.43
-76.47	32.76	2.83	-8.35	-5.58	-5.23	4.65	0.58
-53.76	28.31	12.19	-0.17	4.16	-1.87	-3.50	-1.91
-43.62	15.13	0.25	-0.37	7.37	-1.11	3.55	1.19
-10.64	7.16	-1.27	-7.14	-4.25	-3.27	-1.08	1.03
1.23	8.44	-2.35	-0.80	-2.69	-2.52	-1.58	-0.93
5.79	1.30	-7.72	-2.39	-1.03	0.45	0.45	0.29

~ 721

~ 722

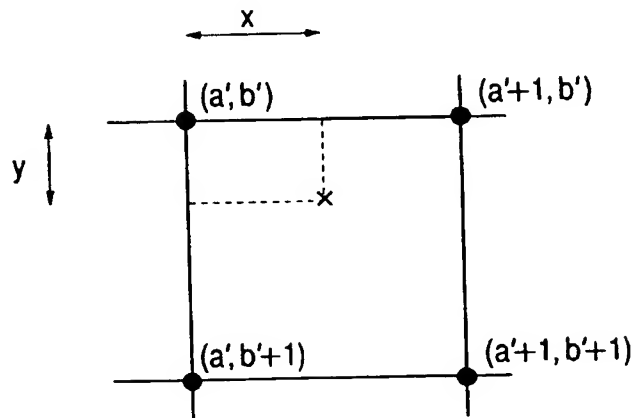
FIG. 23

FIG. 24

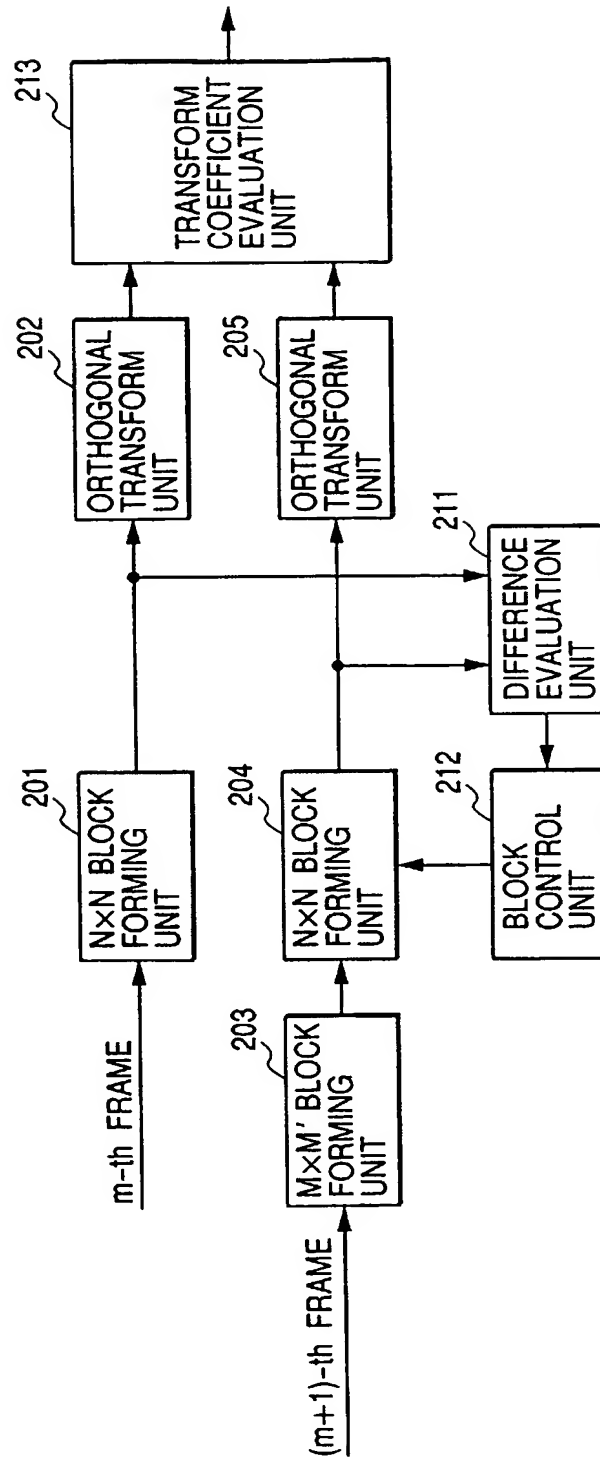


FIG. 25

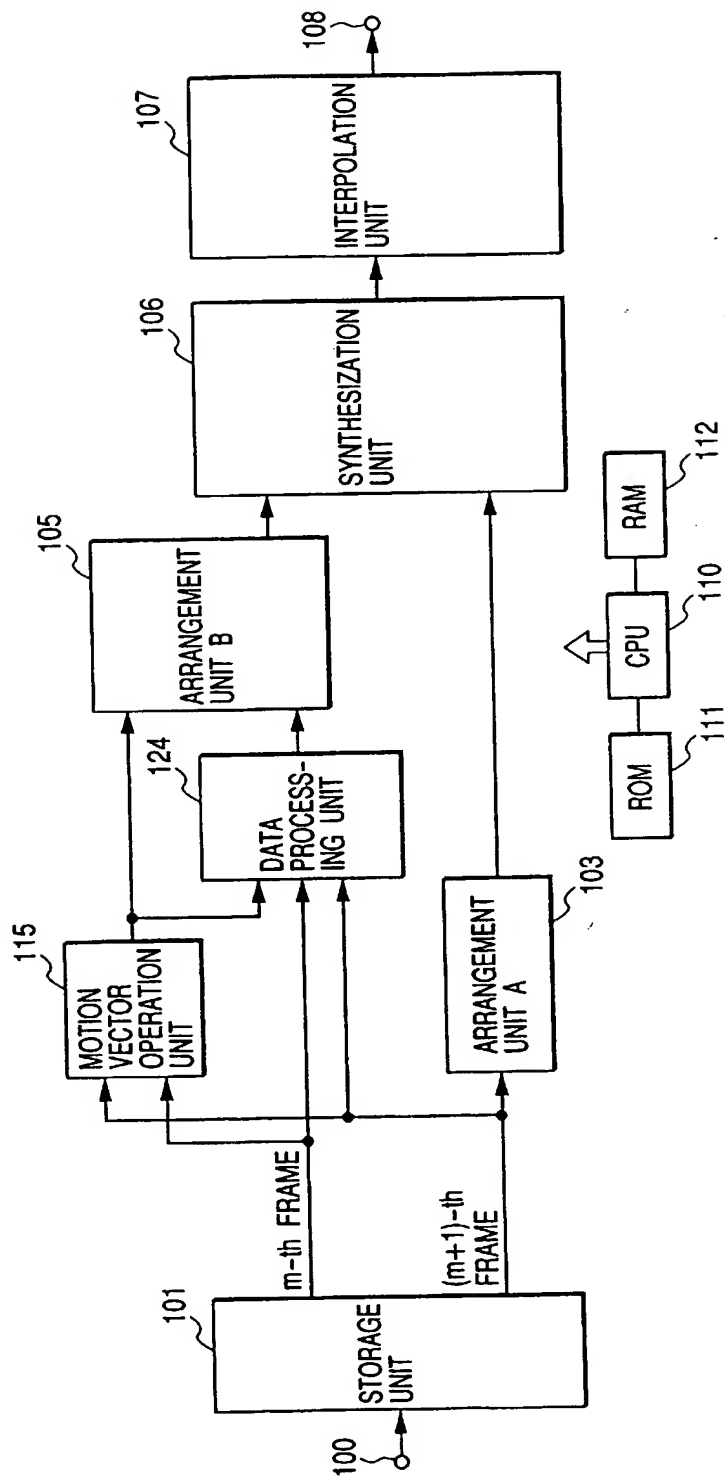


FIG. 26

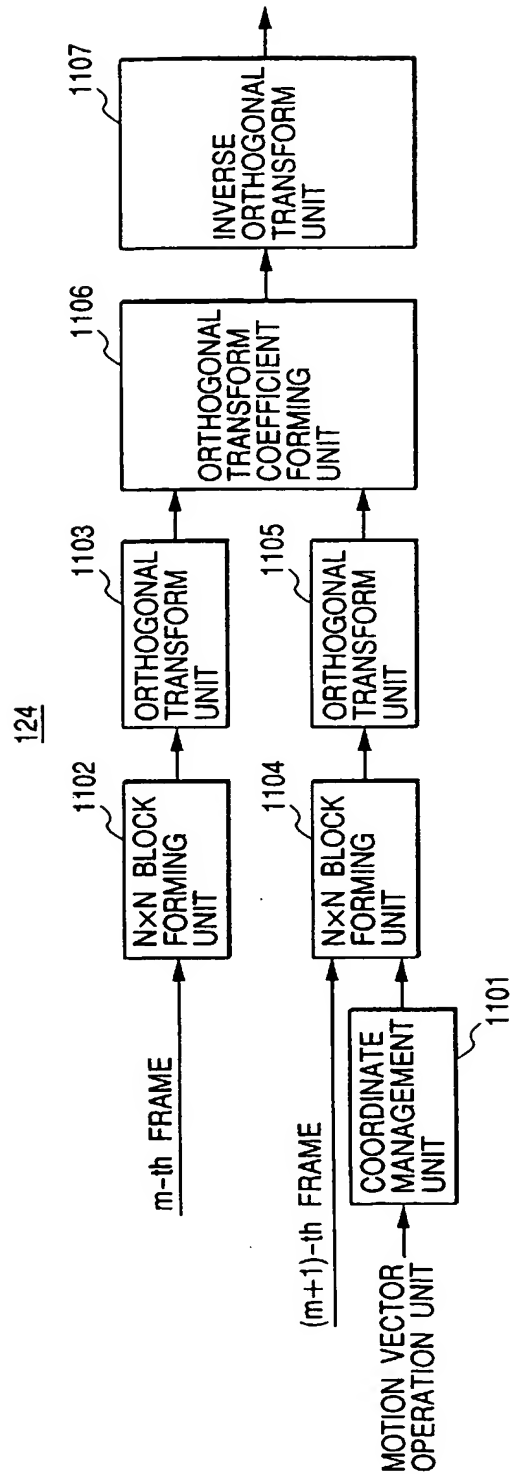


FIG. 27

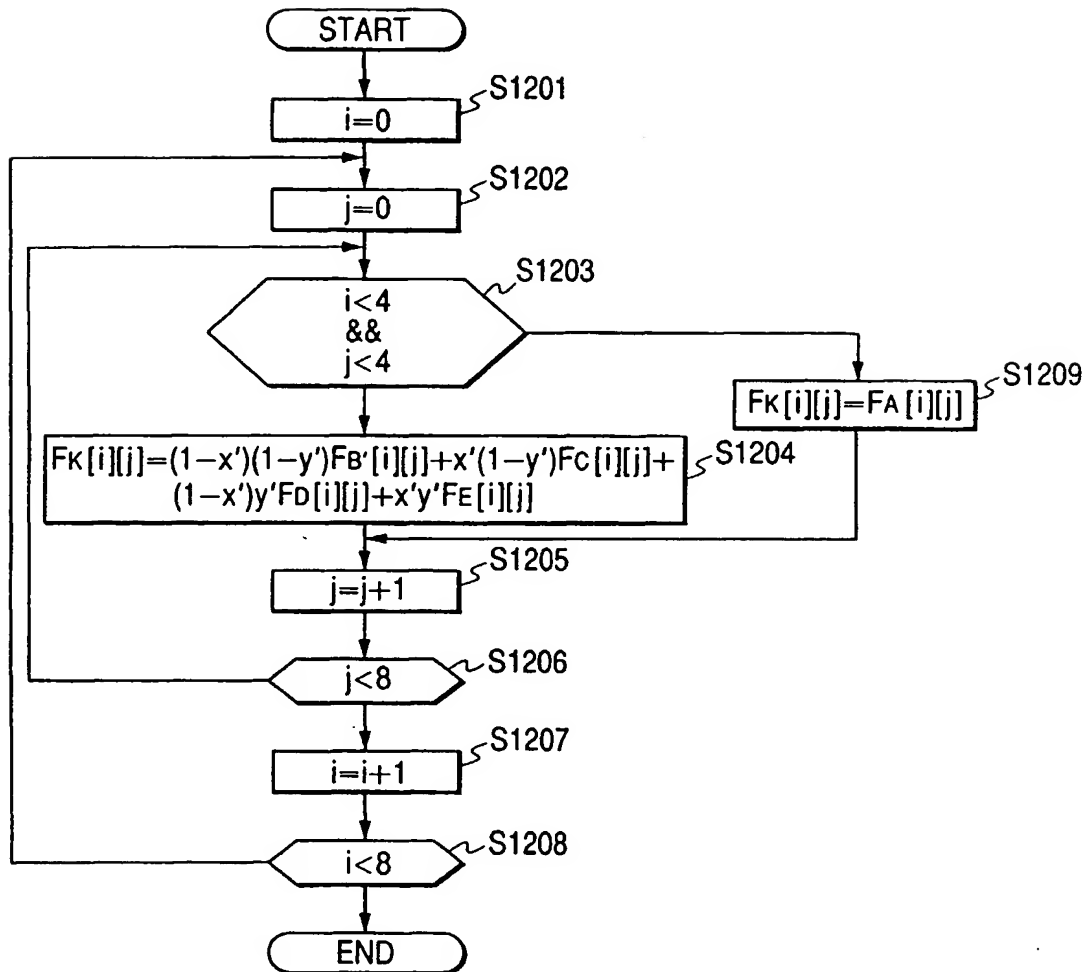


FIG. 28

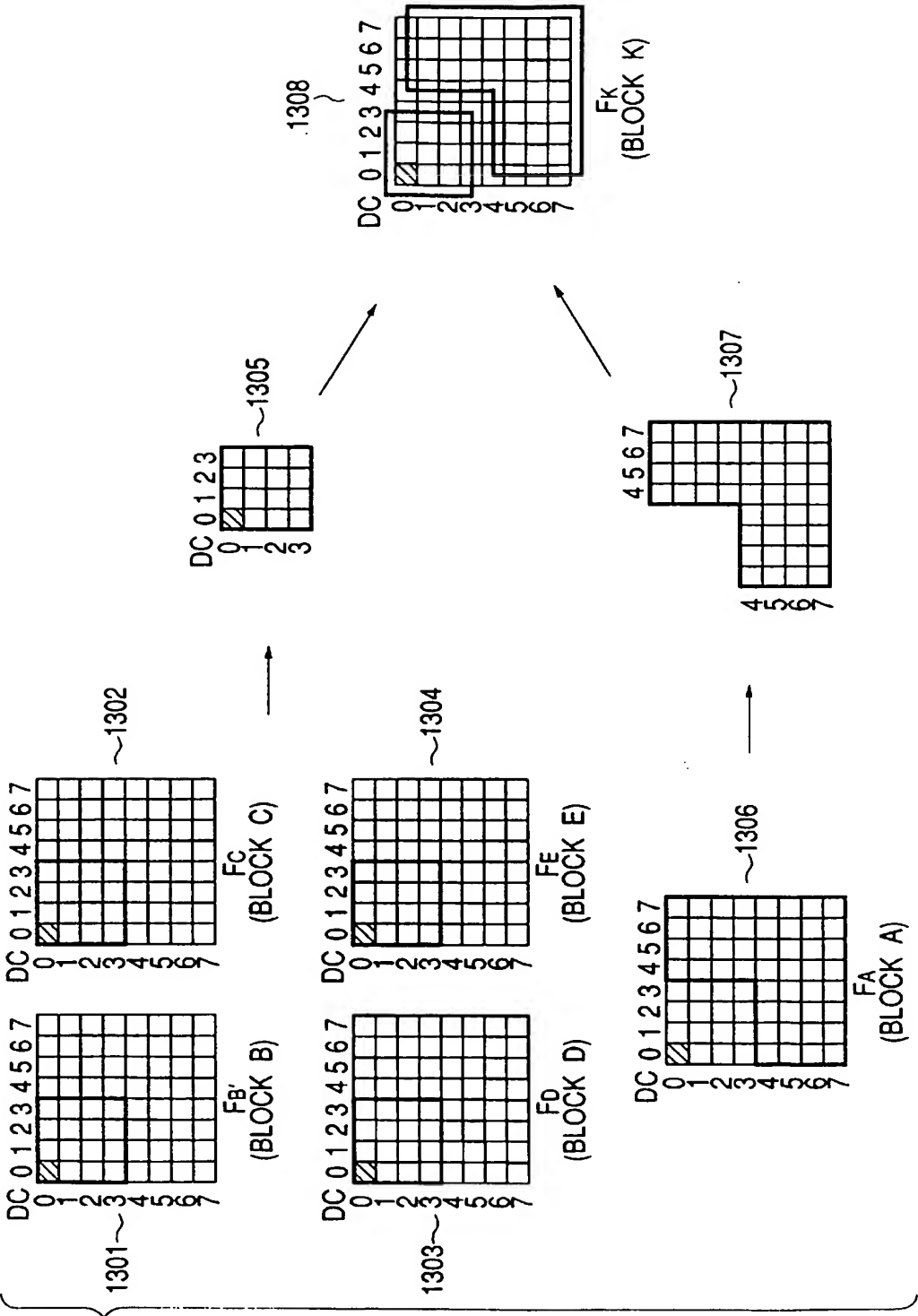


FIG. 29**BLOCK A****IN**

188	192	191	192	192	198	197	164
191	190	192	197	196	189	114	69
192	197	205	204	188	88	5	40
189	193	197	187	102	0	48	104
190	195	190	101	13	51	117	164
206	203	146	54	45	108	170	202
199	183	118	51	68	145	204	200
198	171	40	0	123	199	196	187

731

DCT

1178.50	174.46	147.27	-12.12	-29.50	-21.41	0.15	2.15
92.83	131.72	-256.40	-41.94	56.76	19.60	5.99	-4.24
112.98	-170.64	-1.32	167.87	-44.20	-24.42	-5.76	-2.32
55.63	-81.43	113.39	-45.84	-60.88	41.36	5.36	-2.86
-11.25	-30.26	40.44	-27.04	9.25	9.59	-15.40	2.65
9.15	10.76	-4.63	-43.49	30.41	10.50	-18.86	10.41
-1.61	5.93	-2.01	14.76	14.79	-31.30	2.57	4.72
-4.93	7.42	-2.74	-9.43	-10.99	1.66	15.49	-3.37

732

FIG. 30**BLOCK B'****IN**

188	186	189	192	190	199	206	155
190	187	186	196	205	198	125	62
191	198	201	199	192	80	0	36
191	193	199	188	85	0	26	85
186	200	198	99	0	36	109	161
193	204	151	47	35	106	167	209
203	190	120	37	48	152	206	193
204	176	31	0	103	204	204	188

741

DCT

1159.75	184.32	155.88	-11.60	-47.00	-15.20	2.00	-5.70
95.65	128.49	-276.11	-31.39	68.09	20.30	-0.33	8.22
127.18	-187.82	5.86	185.38	-49.36	13.25	-13.25	-3.28
55.92	-88.27	112.67	-57.29	-66.87	40.80	7.49	3.80
-17.00	-18.24	40.78	-31.54	11.75	19.71	-13.91	-5.83
0.37	22.37	-3.90	-38.99	24.69	11.59	-9.66	6.42
-2.62	-1.38	-1.25	5.44	22.61	35.64	-0.86	7.18
-4.41	10.93	4.07	-13.99	-9.83	0.43	9.39	4.71

742

FIG. 31

BLOCK C							
IN							
186	189	192	190	199	206	155	125
187	186	196	205	198	125	62	26
198	201	199	192	80	0	36	26
193	199	188	85	0	26	85	139
200	198	99	0	36	109	161	207
204	151	47	35	106	167	209	208
190	120	37	48	152	206	193	189
176	31	0	103	204	204	188	190
DCT							
1105.25	88.47	157.01	82.13	14.00	-10.74	-4.42	4.15
44.91	277.30	-173.52	-147.21	-37.66	16.85	-0.88	-4.08
117.77	-124.26	-186.44	141.08	69.55	5.52	7.14	1.86
92.27	-122.98	90.11	69.97	-62.01	-44.14	4.46	-3.70
10.50	-64.81	63.27	-21.57	-13.25	-2.99	26.02	-1.41
4.62	11.15	29.11	-36.68	-23.73	10.80	8.41	-7.89
-1.16	-3.39	0.64	-10.89	22.88	28.72	-19.56	-4.13
-5.17	10.38	13.33	2.06	-7.98	-9.66	-9.53	-2.07

~ 751

~ 752

FIG. 32

BLOCK D							
IN							
190	187	186	196	205	198	125	62
191	198	201	199	192	80	0	36
191	193	199	188	85	0	26	85
186	200	198	99	0	36	109	161
193	204	151	47	35	106	167	209
203	190	120	37	48	152	206	193
204	176	31	0	103	204	204	188
201	147	6	17	170	203	192	194
DCT							
1112.87	152.42	204.74	33.09	-35.87	-42.65	-1.87	-4.76
13.94	252.09	-253.98	-143.28	57.57	34.94	17.40	1.36
67.89	-66.93	-139.90	193.03	42.96	-47.76	-16.71	2.11
76.27	-74.98	30.88	55.43	-80.00	11.95	12.74	-4.64
32.13	-63.77	33.48	9.95	-26.62	5.53	6.02	3.31
-0.59	-23.71	34.72	1.93	-34.59	29.50	-1.50	-14.80
10.71	-3.75	-2.21	-17.80	3.45	30.85	-7.85	0.21
3.40	-12.66	2.94	12.87	10.50	-7.93	-9.35	-4.52

~ 761

~ 762

FIG. 33**BLOCK E****IN**

187	186	196	205	198	125	62	26
198	201	199	192	80	0	36	26
193	199	188	85	0	26	85	139
200	198	99	0	36	109	161	207
204	151	47	35	106	167	209	208
190	120	37	48	152	206	193	189
176	31	0	103	204	204	188	190
147	6	17	170	203	192	194	190

771

DCT

1064.87	21.17	166.91	104.78	56.88	8.46	-8.93	2.86
-38.30	363.34	-46.29	-191.47	-85.73	-11.08	-7.63	4.04
25.79	35.66	-258.59	17.45	105.41	54.02	-3.35	-1.00
64.99	-34.36	-58.78	112.50	-2.63	-35.73	-7.98	7.79
45.38	-64.19	-1.94	39.81	-6.12	-13.21	-5.01	-1.45
10.13	-40.76	21.58	30.50	-10.73	-31.98	23.54	9.04
14.89	-7.03	5.65	-12.65	-26.75	-8.72	19.84	-3.30
6.33	-16.23	-5.69	-0.32	12.47	13.50	5.81	2.14

772

FIG. 34**BLOCK K****DCT**

1134.81	150.17	165.94	21.62	-29.50	-21.41	0.15	2.15
62.44	194.24	-238.36	-84.09	56.76	19.60	5.99	-4.24
107.96	-139.26	-74.05	168.01	-44.20	-24.42	-5.76	-2.32
67.11	-88.91	82.38	-1.68	-60.88	41.36	5.36	-2.86
-11.25	-30.26	40.44	-27.04	9.25	9.59	-15.40	2.65
9.15	10.76	-4.63	-43.49	30.41	10.50	-18.86	10.41
-1.61	5.93	-2.01	14.76	14.79	-31.30	2.57	4.72
-4.93	7.42	-2.74	-9.43	-10.99	1.66	15.49	-3.37

781

OUT

184	189	192	197	196	190	168	119
190	191	192	190	179	166	93	52
195	199	199	182	152	58	0	54
196	190	179	157	72	0	57	130
198	182	159	74	8	65	136	179
207	184	114	38	61	140	189	201
190	163	96	46	88	172	215	191
180	154	29	2	137	214	199	178

782

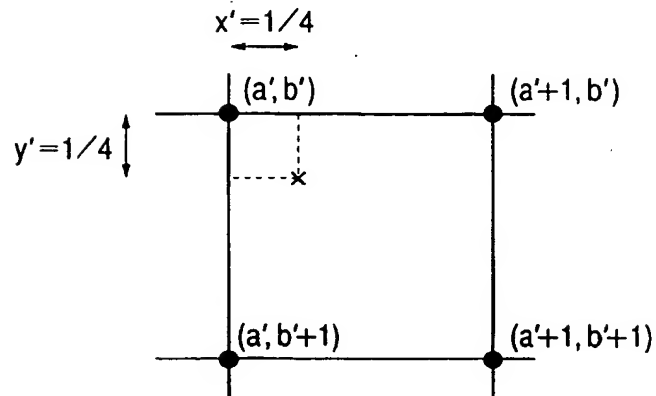
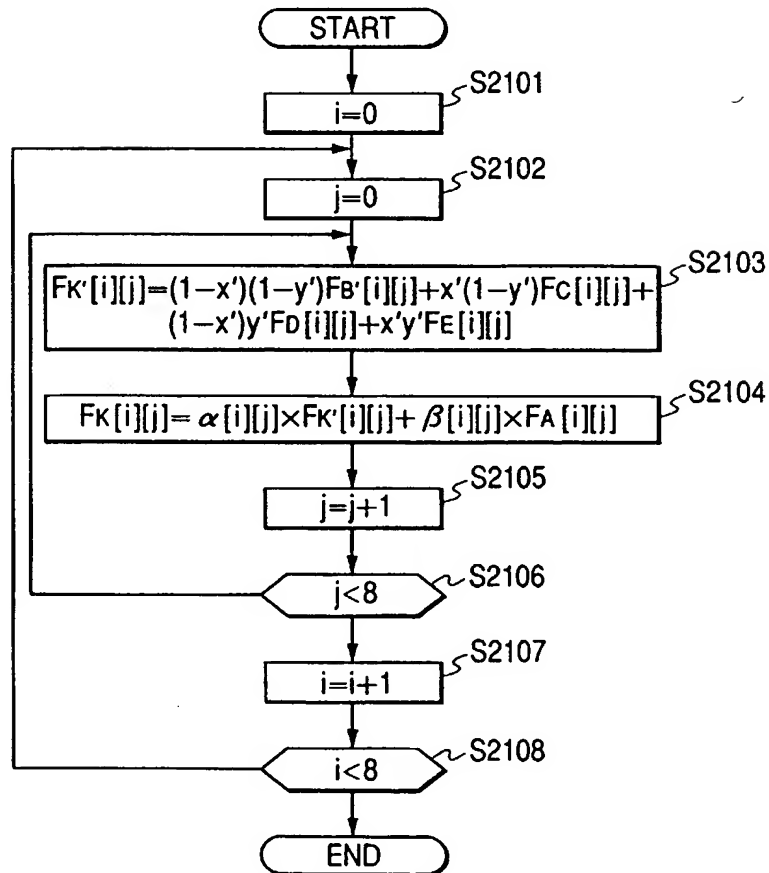
FIG. 35**FIG. 36**

FIG. 37

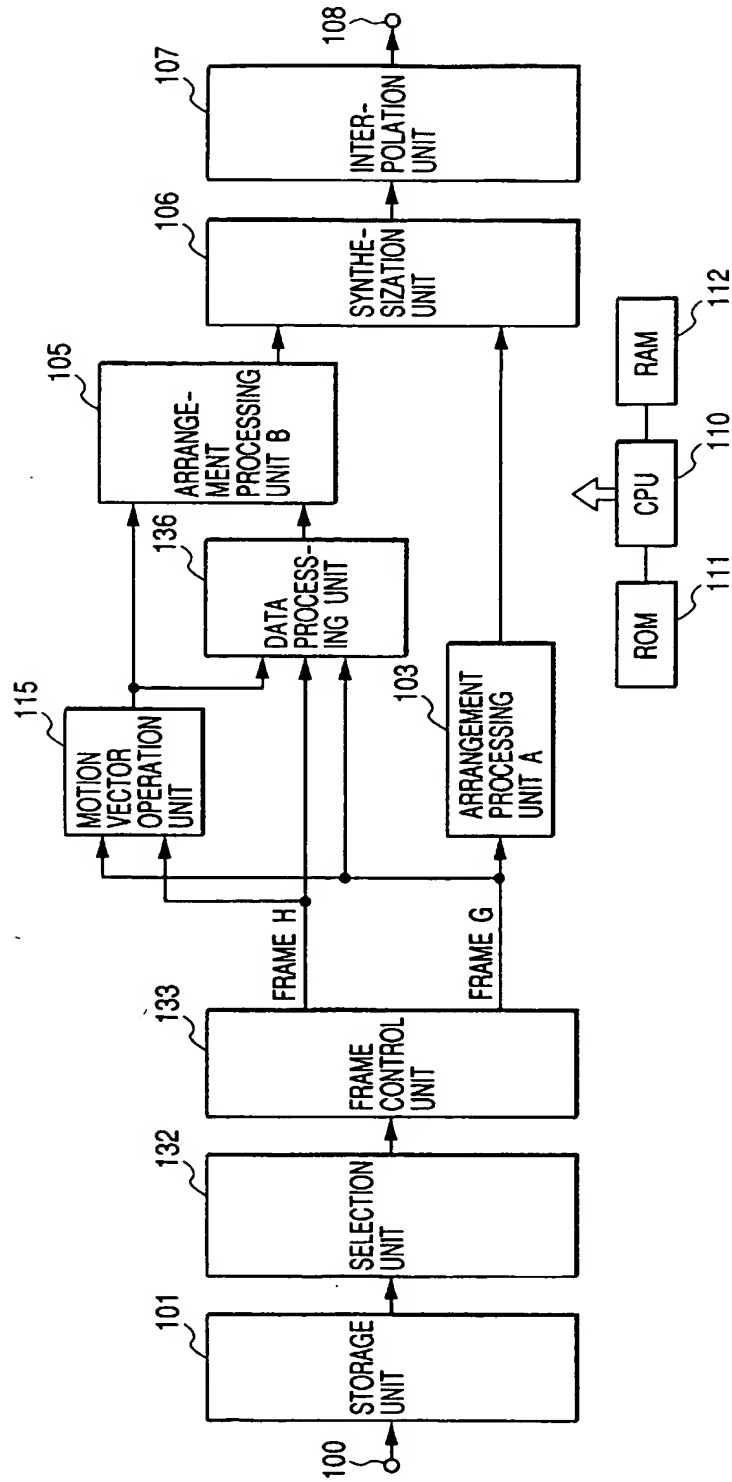


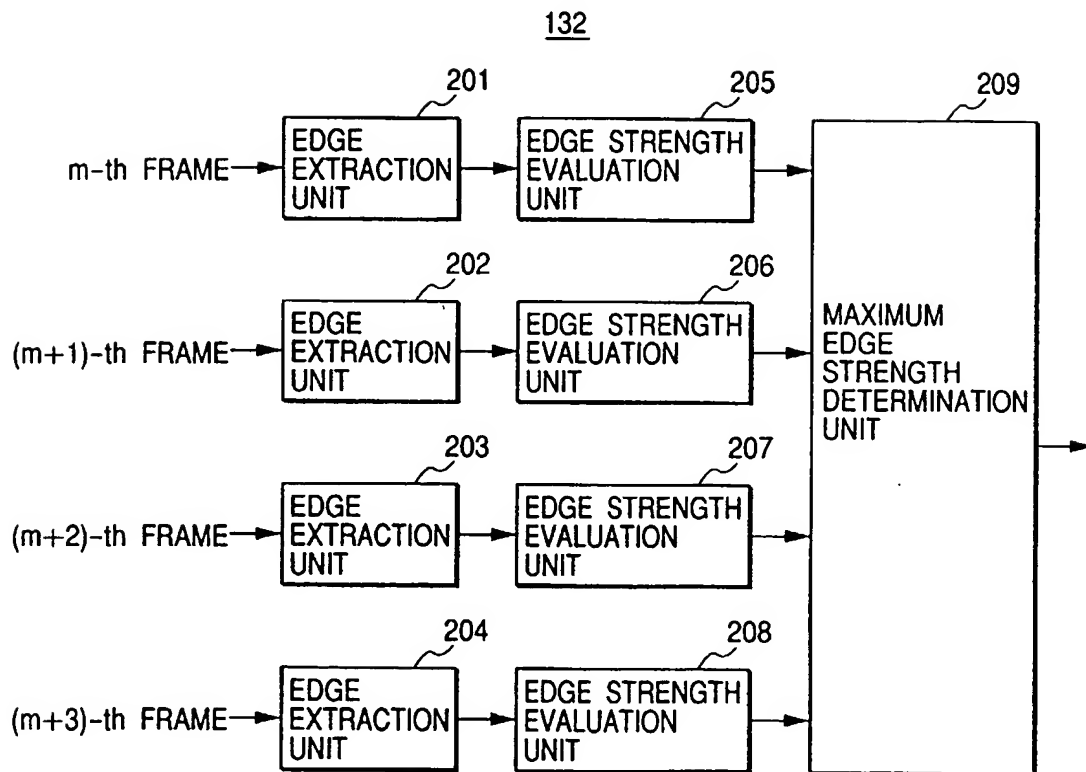
FIG. 38

FIG. 39

1	1	1
1	-8	1
1	1	1

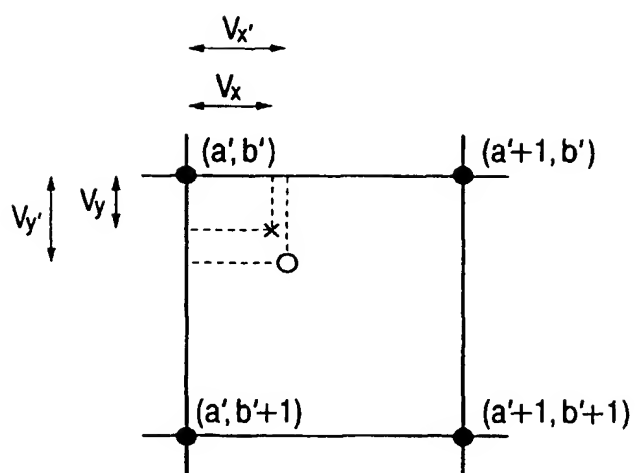
FIG. 41

FIG. 40

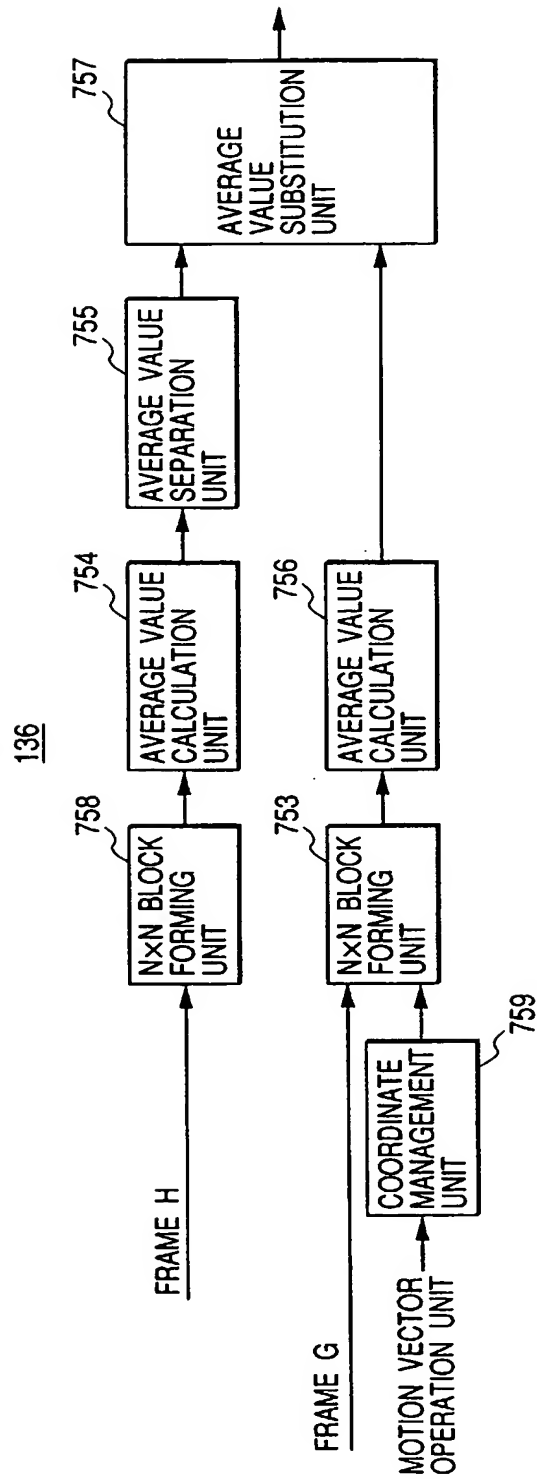


FIG. 42

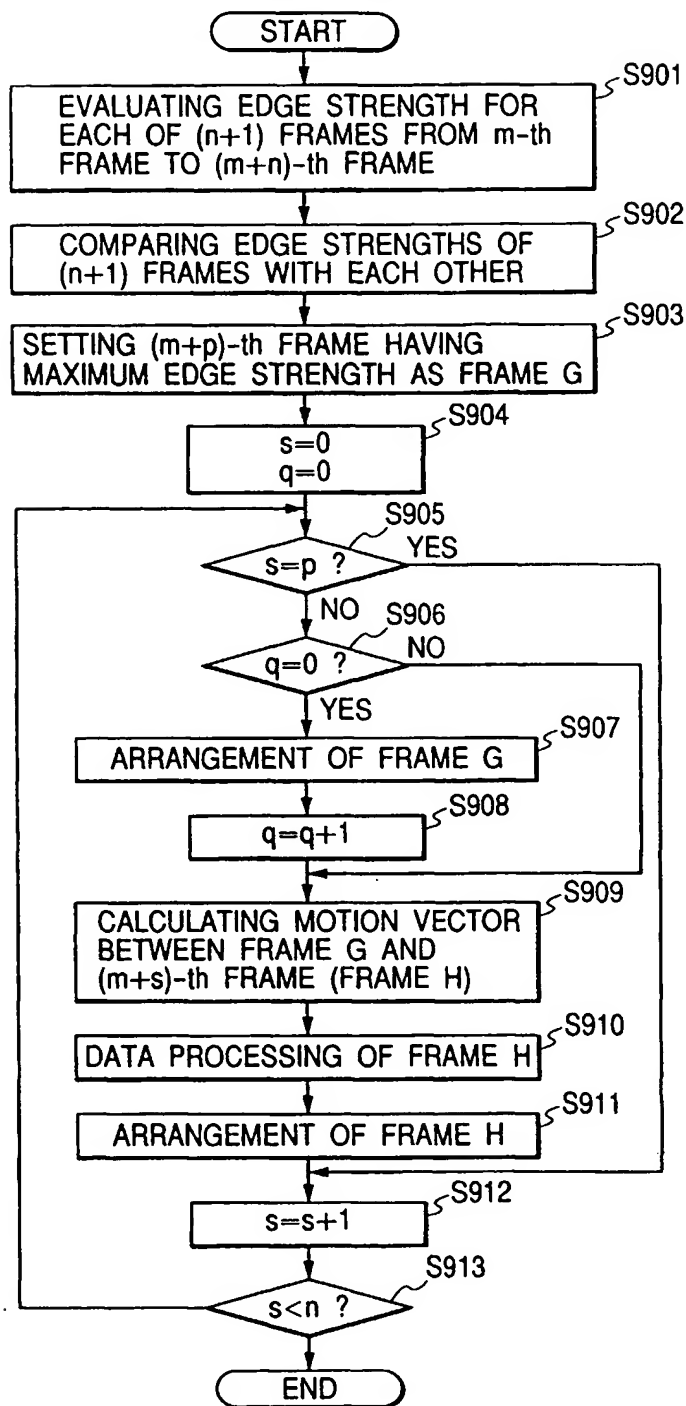


FIG. 43

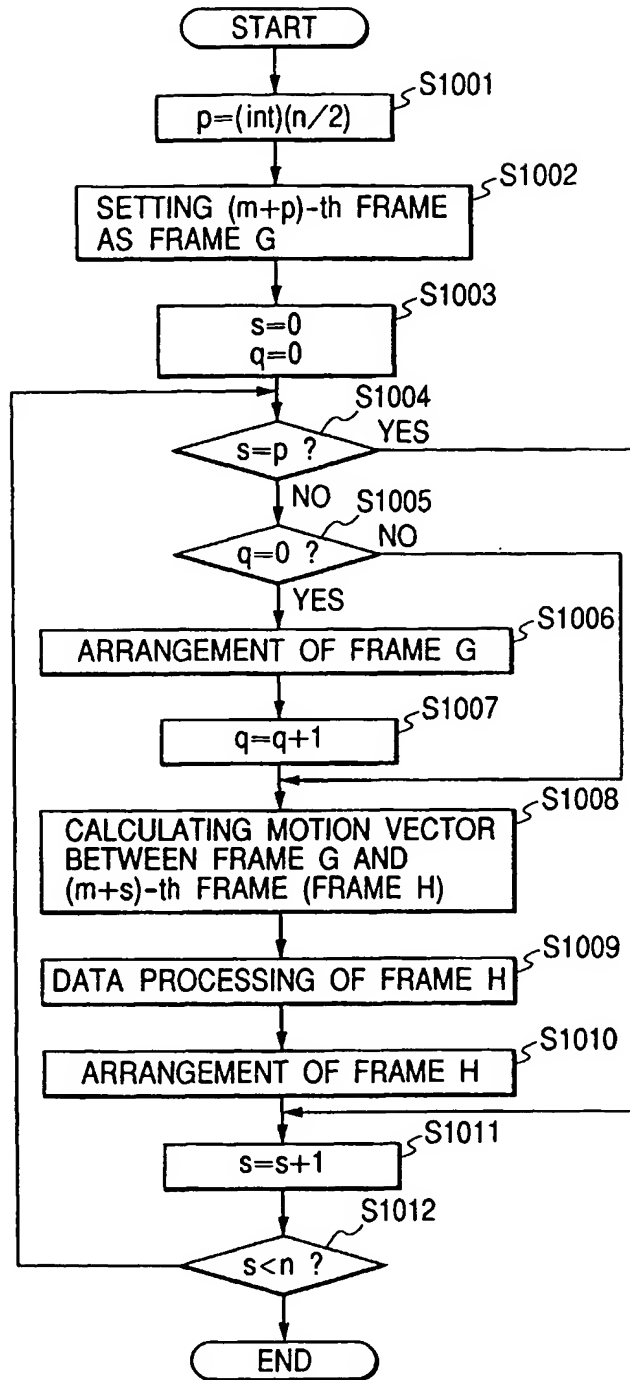


FIG. 44

